Oshkosh Restaurant Composting Pilot Program Proposal

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Executive Summary

To combat the massive issue that is food waste in the U.S., our group decided to create a program that would deal with this rising issue, starting at a local level, in the city of Oshkosh, Wisconsin. Oshkosh is home to countless bars and restaurants where food production and consumption occurs extensively, further resulting in high amounts of food waste. Making these restaurants our target, a collection of this food waste that could then be composted at the University of Wisconsin Oshkosh's biodigester and converted to various forms of sustainable energy was the basis of our proposal.

In the formation of this pilot program proposal, we examined multiple similar curbside composting programs that already exist. The primary benchmarking example we used as a foundation for this proposal was the composting program in Stevens Point, Wisconsin. We used this composting program as well as discussion with stakeholders to gain insight from several restaurants that our proposal would directly deal with along with sustainability experts and other stakeholders. Using these examples and important stakeholders, we were able to formulate a well-rounded composting program proposal. Participating restaurants would pay a monthly fee of approximately forty five dollars and either buy a composting bin through the program, or provide their own to save additional money. They would be provided with a guide on what waste can be included in the bin as well. These bins would then be picked up each week, or as needed if higher frequency must exist, by a representative where they would then be hauled to the UW Oshkosh biodigester. The food waste would be converted to clean energy that could be used in various forms. In turn, these restaurants would be producing less waste that required disposal at landfills, lowering their garbage collection fees while simultaneously participating in a environmentally sustainable program.

We did, however, come across some potential barriers that might come with the program, as examined in the barriers section of this report. One of the primary concerns that many of these restaurants had was how participating in this program would directly benefit them. Not only could they advertise that their restaurant is incorporating sustainable action and be considered an environmentally friendly establishment, but they could reduce the costs of their waste pickup fees, which is addressed in our costs section. On top of this, the other primary barrier was the small kitchen size that many of these restaurants have. Finding room for an additional composting bin that would also potentially come with an odor was striking to these stakeholders. By incorporating a composting bin, the necessity for large garbage bins would be reduced, creating space for these composting bins. Further elaboration on these costs and barriers is emphasized in our *Costs* and *Barriers* sections.

Background & Problem Identification

The City of Oshkosh currently offers curbside trash and recycling services for the community, but does not have any kind of municipal composting program. These services are organized by neighborhood and pick-ups occur on varying days of the week. As waste management services in Oshkosh stand, most residents are disposing of their food waste and organic material in the trash. This waste is then sent to a landfill. Food waste that goes to a landfill is a major issue because, according to the Environmental Protection Agency (2021), “Municipal solid waste landfills are the third-largest source of human-related methane emissions in the United States, accounting for approximately 15.1 percent of these emissions in 2019” (sec. 1). Methane is a potent greenhouse gas that contributes to global warming. By diverting food waste out of landfills and instead disposing of it through composting practices, emissions are greatly reduced.

Though the issue of food waste is a global problem, there are still ways we can combat this locally. The City of Oshkosh recognizes the food waste problem in chapter 8 of their Sustainability Plan which states as a goal to “continue partnering with the renewable energy facility biomass digester to convert community organic waste to electricity and heat”. In response to the massive food waste issue and the City’s Sustainability Plan, we decided to propose a pilot composting program.

For Oshkosh residents and businesses, sorting out their food waste could also have an economic benefit. According to the USDA, “trash pickup is less expensive if volume is reduced by keeping wasted food out of the garbage. In addition, some haulers lower fees if wasted food is separated from the trash and sent to a compost facility instead of the landfill” (Buzby 2021). By offering the option of a curbside composting program in the city of Oshkosh, participants would see economic benefits as well as know that they are making a difference environmentally.

Recommended Action

Overview

We recommend the creation of a fee-for-service curbside composting pilot program for Oshkosh-area restaurant food waste. Collected waste would be composted at the UW Oshkosh biodigester and converted to energy. We propose a program that would provide receptacles for food waste to the interested restaurants which would then be collected by UW Oshkosh Biogas. The University has recently purchased waste hauling trucks for this purpose. Routes and route frequency would be determined based on the necessity of each restaurant. Based on our survey of area restaurants, we

suggest options for pick-up twice weekly or once per week. Participating restaurants would pay a monthly fee of approximately $45 per pick-up which covers the cost of a UWO Biogas employee driving to the sites and collecting the bins, along with maintenance and fuel costs for the trucks. The composting bins will be picked up and then hauled to the UWO biodigester where the food waste will be converted to clean energy.

The City of Oshkosh would assist with this program by providing promotional and education materials to restaurants. We recommend the creation of an educational pamphlet that would describe what can and cannot be composted through this program. Creation of this pamphlet would require working with UWO Biogas. The pamphlets would be provided to restaurants after they join the program. We are also recommending that the City provide a window sticker to restaurants who participate in the composting program so that they can share with their customers that they compost their food waste. This would be a marketing tactic for restaurants and a way to communicate their sustainability efforts.

Why Restaurants?

Our recommendation of a composting program targeted at area restaurants is due to the fact that restaurants accrue more food waste than residential households and there is a smaller risk of contamination. If plastics or other non-organic materials become mixed in with food waste that is sent to the biodigester, it will never break down and will have to be removed by hand. Restaurants would supply pre-consumer waste from their kitchens that would be less likely to include contaminant material. By beginning with a restaurant composting program, there is a greater chance of success while still leaving room for a residential composting program later on.

Fee Structure

We also encourage the program to be made as cost effective as possible for small businesses by creating a fee structure that is proportional to food waste production. This would allow large dining facilities to carry a large financial burden and offset costs for small restaurants. We suggest fees in the range of $35-$45 per month for once weekly pickup. This cost would be proportional for restaurants requiring more or fewer pickups. Rationale for this fee structure will be discussed in the Costs section.

City Government Assistance

We are recommending that the City assist with the creation of this program and support the operations of the composting program, especially during its inception. This position would be fairly minimal in responsibilities and could be in conjunction with any

other City government position. The main responsibility of this position would be to communicate with area restaurants about the program, the benefits of composting, and why this program would be beneficial to them. Based on our conversations with stakeholders, as we will address later on, educating business owners on why this program is cost-effective and advantageous to them will be crucial for the success of the program. City support and promotion would add legitimacy to the program, increasing the likelihood of greater restaurant participation.

Costs

Collection Bins

The cost of the collection bins through biogas would be $90 per bin. If the restaurant can provide their own bin then, they would not have to purchase it through biogas. Another option for restaurants is that they could purchase one online through ULINE. This would be a Rubbermaid Brute collection bin with a lid for an estimated cost of $35 for a 32 gallon bin and an additional cost of $15 for a single lid. As long as the collection has a sturdy lid to keep the compost inside the bin.

Labor Costs

City Labor

James Rabe, the Director of Public Works for the City of Oshkosh, shared a city perspective of what some labor costs would look like for our potential program. A City employee would need to be assigned to support the program. Compensation for this additional labor could be done through the utilization of DNR Recycling staff. At this time, they are responsible for this area of the city's salary and benefits. The DNR Recycling offers employment packages through a grant which could be utilized to compensate for additional labor associated with the composting program.

UWO Biogas Labor

Potential labor costs for UWO biogas would be the pickup up fee from the restaurants back to UWO biogas to dispose could be as high as $45 per route pickup. That depends on how many restaurants are having their compost picked up by biogas as well as how often a restaurant is looking to have their compost picked up. A lot of restaurants that were surveyed are local restaurants on or near downtown Main Street. If there are quite a few restaurants who are close to one another who are interested and

want their compost to be picked up then, the cost would be lower than $45 per route pickup. This route pickup cost would include maintenance, fuel, and a staff member or an intern to complete the pickup. This information was provided by Brian Langoff.

Bag Liners

More information that was discussed with James Rabe is that bag liners could be beneficial and should be compostable for the collection bins. The bins that are being suggested would be 32 gallon bins since they would be used by restaurants who accumulate a lot of food waste. An estimate for 32 gallon bag liners that are compostable would cost $34 for 50 liners per box. The brand Stout from Home Depot carries these compostable bag liners.

Promotional Costs

By joining this pilot program restaurants would receive a window sticker for their establishment to show their customers the restaurants environmental efforts of getting their food waste compost by UWO biogas. This would serve as promotional material which could help recruit other restaurants to join this pilot program.

Educational pamphlets would play an important role in educating restaurants on the value of composting. Composting would help reduce food waste in our landfill which at the end of the day that will be better for everyone. The cost of this educational material could be through the DNR. While speaking with James Rabe, he shared that the DNR collects funds through tipping fees at landfills. The funds then can be used for the local government in helping out certain programs. Those funds could help mitigate the costs of educational pamphlets to educate restaurants on the importance of composting which would help reduce the amount of food waste in the landfills.

Savings to Restaurants

James Rabe also shared that for restaurants, by participating in this program that restaurants could save money at the end of day. A restaurant's waste pickup fee may lower if they chose to compost their food waste. Depending on the restaurants monthly waste pickup costs - compared to our suggested fee of up to $45 per route pickup fee. This varies on how many restaurants participate and how often a restaurant needs their compost picked up by biogas.

Restaurants will also benefit from joining this program in that they will be able to boast their sustainable efforts from involvement in this green initiative that reduces harmful food waste while also reducing fossil fuel consumption. By joining this pilot

program restaurants would receive a window sticker for their establishment to show their environmental efforts of composting their food waste.

Line-Item Breakdown of Costs

32 - gallon (single) collection bin purchased by restaurants	$35
32 - gallon (single) matching collection bin purchased by restaurants	$15
	or
32 - gallon (single) collection bin purchased through UWO biogas	($90)
32 - gallon compostable bag liners purchased through retail store with 50 liners per box	$34
Single route pick - up estimate depending on how many restaurants participate in this pilot program. This cost is on the high end but would be lower if there are multiple sites to pick-up rather than a single restaurant pick-up.	$45

Total range of initial cost to restaurants:	$129-$169
Total recurring cost to restaurants per pick-up:	$45

Stakeholder Identification

Introduction

Stakeholders are vital to any project when considering people who may be impacted or invested in the outcome. Especially in regards to a city-wide effort that requires the participation of several different groups of stakeholders. From restaurant owners to city employees and experts, these stakeholders' opinions need to be included throughout the entire process of a city-wide composting initiative. The creation of a curbside composting program in Oshkosh would mean collaboration between many different facets of the community. As our group identified our stakeholders, we took into consideration questions such as "Who makes decisions when it comes to waste collection?" "Who will be generating the food waste?" and "Who will be responsible for composting the food waste?". All of these questions led us to identify our stakeholders as 1. Oshkosh restaurants 2. Brian Langolf, the Director of Biogas Systems and Research Development 3. Brad Spanbauer, Sustainability Advisory Board member 4. Brandon Nielsen, City Planner 5. James Rabe, Director of Public Works. These five

entities hold insight and decision making power when it comes to creating a composting program.

Oshkosh Area Restaurants

In order to gauge interest in a potential curbside composting project, we conducted a phone survey of Oshkosh area restaurants. These were mostly small, locally owned businesses that we thought would have a stake in the Oshkosh community. The survey consisted of three questions that would measure their interest in such a program, the amount of space their kitchen had for another waste collection bin, and their willingness to pay a fee for this service. We organized responses to the survey questions in pie charts in order to visualize how many respondents were actually interested in this program.

The first question we asked participants was “Would you be interested in a curbside composting program in Oshkosh?” (*Fig. 1*). Responses ranged from “yes” or “no” to “unsure” or “maybe”. The proportion of restaurants that responded “yes” was 45.5%. These respondents were the most enthusiastic and were very interested in talking to us about our project and potential ideas that they had. Restaurants such as Pilora’s Cafe, Planet Perk Coffeehouses, and Bar 430 fit into this category. Restaurants that responded “no” and therefore had no interest in such a program were 36.4% of respondents. As a group, we were surprised to find that this percentage was so high, especially since we specifically identified local restaurants that would most likely have a stake in the community.

Restaurants that were particularly uninterested and enthusiastic in their “no” response were Rocky’s Tacos and Subs, The Roxy Supper Club, and The Varsity Club. Still, other restaurants fell into the “maybe” category in which they were interested but reluctant to say “yes” without more information. Restaurants that had this response were Takiza Mexican Restaurant and Dockside Tavern. This is a group that we view as being still promising potential members of a curbside composting program.

The second question that we posed to area restaurants was “Would your restaurant have the space and capacity to collect food waste in a container separate from trash and recycling?” (*Fig. 2*). This is an important question to ask because space is an issue in many commercial kitchens. 45.5% of respondents said that, yes, they would have space, however, 45.5% also said that they wouldn’t. 9.1% were unsure. Answers from this question make it clear that the waste bins provided by the composting program will have to be rather small in order to accommodate small kitchens.

The third question that we asked in our survey was “Would you be willing to pay a fee to participate in a composting program?” (*Fig. 3*).Of the restaurants who indicated that they were interested in the program, 57.1% said they would be willing to pay a fee for the service. Of the interested restaurants, 42.9% said they would “would not be

willing" or "would probably not be willing" to pay a fee. This question provides important information about the impact that high fees could have on restaurant participation in the program.

Something that is important to consider when analyzing responses from area restaurants is that they are businesses and their chief concern is to make money. They are not non-profit organizations or academic institutions in which they have an altruistic mission. The businesses need to know "what's in it for them" in order to get on board with a composting program. The program needs to save them money and be worth their while. These are important points to consider when designing a curbside composting program and creating a fee structure for the service.

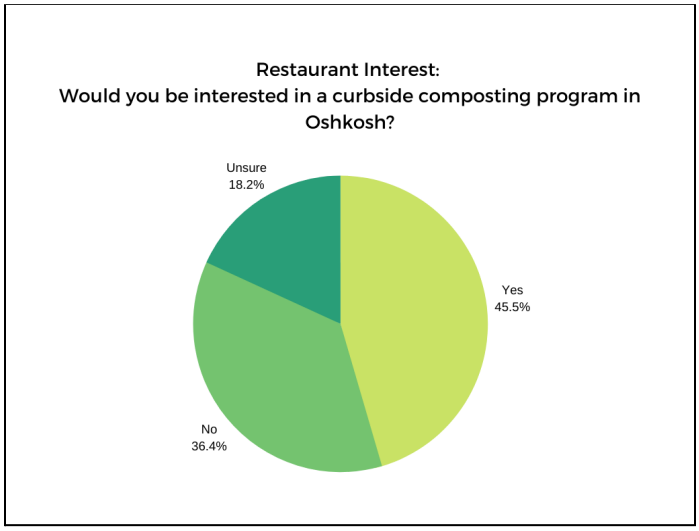

Figure 1 (green chart): Survey question on interest

Figure 2 (orange chart): Survey question on kitchen space

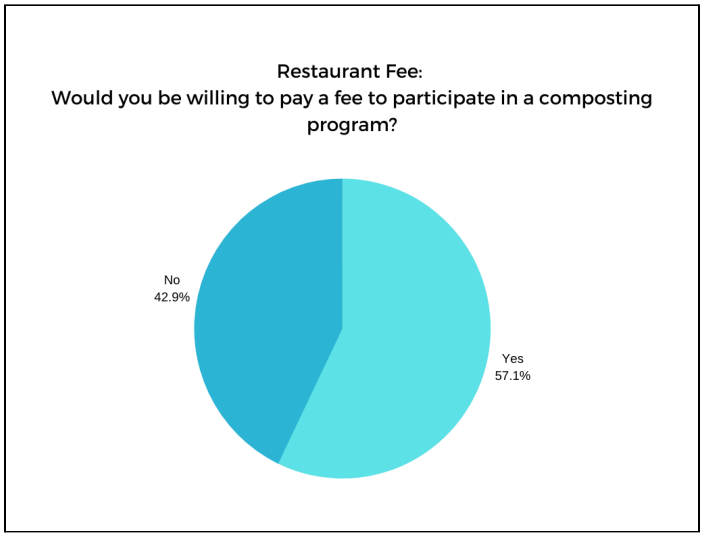

Figure 3 (blue chart): Survey question on fee structure

Pilora's Cafe

Pilora's Cafe is located at 910 North Main Street in Oshkosh. The cafe is a popular breakfast spot in the downtown area. Pilora's General Manager, Cory Tellock, participated in our compost program survey and expressed his desire for curbside composting in Oshkosh.

Tellock informed us that Pilora's was extremely interested in participating in a composting program directed towards restaurants because they are working to be more sustainable and community-minded. His suggestion for a collection container was 30-35 gallon Brute plastic bins. This would allow for ample storage of food waste while also being easy to spray out with a hose to clean. Pilora's would require pick-up of their compost at least 1-2 times per week because of how much waste they generate and for health and hygiene reasons, according to Tellock. Tellock stressed that it would become a problem for food waste to be stored in the bins at the restaurants for too long. In regards to paying a fee for the compost pick-up, Tellock said that Pilora's would be willing to do so because they see this as being a very valuable service. He also suggested that the soil material that results from the composting process could be shared with restaurants as an added bonus for participating in the program. For Pilora's, this added perk would make the program especially worthwhile.

Pilora's Cafe offered valuable insight into what Oshkosh restaurants may be looking for in terms of a composting program. Our Recommended Action takes into account Tellock's comments as well as similar comments from restaurants such as Becket's, Dockside Tavern, and Mama's Noodle Bar.

Brian Langolf

Brian Langolf, the Director of Biogas Systems and Research Development at UW Oshkosh, was another key stakeholder in the proposal due to his direct involvement and oversight of the campus biodigester. In a short conversation Brian he acknowledged that a city composting program would be a great step forward in sustainability by using food waste to generate renewable energy rather than having it end up in landfills. He also said that the biodigester on campus has the capacity to partner with these local restaurants and businesses to take in this additional food waste. Brian also mentioned that the trucks used by the UW Biogas waste collection service use carts ranging from 30-65 gallons in size that could be provided (for a possible cost) to the restaurants. When talking about costs, he said that our cost estimates may be lower than what they are likely to be. Each individual restaurant would have to be evaluated to determine their expected cost, "If you are just collecting from only one sight on main street it could be $40 or possibly more for a weekly service" Biran commented. However these costs could be paid for due to the reduction in garbage services, "the goal for the client would

be to divert the organics (likely 40% of what they put in the trash) to reduce garbage pickup frequency and apply that savings to the organics collection service."

Brad Spanbauer

Not only did we recognize the importance of feedback from area restaurants that would be directly affected by our program proposal, but the necessity for insight from a sustainability expert like Brad Spanbauer was of utmost importance. Brad Spanbauer, the sustainability coordinator at the University of Wisconsin Oshkosh as well as a member on the Oshkosh city's Sustainability Advisory Board spoke with us and provided us with an overwhelming amount of information and support. He explained how he and his colleagues are working on a similar project that is more focused on larger dining operations like Oshkosh Corp., hospital cafeterias and grocery stores. If we start at a larger scale like that of these bigger businesses, we will not only cover a larger scale of food waste, but the potential for other smaller businesses to implement the program would be much higher. He also recommended some specifications that should be necessary in the program like one on one consulting with these businesses to provide proper information on how the program would work and benefit them, as well as a need for a leader of the program in the city that would serve as a composting program coordinator.

Specifically targeting our program proposal, Brad recommended monthly fees for the participation of these restaurants that he and his peers determined. He stated that we should charge between 25 and 35 dollars per month, and any larger scale dining settings like that of Oshkosh Corp. would have a higher monthly fee for their increased amounts of food waste. By charging these larger businesses more, it would also further provide potential negotiations for smaller restaurants to have a lower fee per month if it instilled their participation. He also expressed to us the importance of providing not only a composting bin to each participant that would be used for the collection of the food waste, but also a guide that would inform the companies on what can and cannot be included in the composting bin to prevent potential contamination. Brad not only provided us with beneficial suggestions on the specifications of our proposal, but also opened our eyes to some of the potential barriers that could arise, allowing us to combat them throughout the construction of our program proposal.

Brandon Nielsen

Another stakeholder that we identified was Brandon Nielsen who is the assistant planner in planning services for the City of Oshkosh. Brandon was chosen as an expert due to his knowledge and work with city ordinances or municipal codes that may affect the feasibility of this project. Brandon's relevant expertise would be able to inform or shape discussions about the composting program. He shared that there are no

municipal codes that hinder such a project, nor are there new ones that will be needed to make the program work. Furthermore, Brandon is also the staff liaison of the Sustainability Advisory Board, meaning he is engaged in helping the City of Oshkosh become more sustainable. Brandon's interest in the project would be motivated by his interest in environmental issues. Between his work with city planning and his involvement with the SAB, Brandon actively works towards bettering the environment.

James Rabe

Lastly, a stakeholder that was identified was James Rabe. Who is the Director of Public Works for the City of Oshkosh. James Rabe would be considered an expert in this field due to his experience and knowledge regarding the collection system here in Oshkosh. He was able to give a city perspective ranging from barriers regarding municipal collection, the manpower of collecting compost, and educating restaurants about composting. James also stressed the importance of composting and how educating not only the public but restaurants as well was imperative to help reduce the amount of waste in our landfills.

Throughout this discussion James stressed the importance of education. James' recommended partnering with the DNR Recycling staff to help with educating restaurants. The DNR Recycling staff does a lot of educational pamphlets and educational workshops with the community. By doing so with restaurants it would help educate them more in regards to the importance of composting and its benefits. He also shared that he believes that throughout the Common Council that there would be some support already before presenting our project proposal. The reason for this is that this pilot program would be for local restaurants which are on a smaller scale which could be easier to implement in the City of Oshkosh.

Benchmarking

Stevens Point, WI

The city of Stevens Point, located in central Wisconsin, is our primary benchmarking example. This mid-size city with a population of just over 25,000 residents ("Quick Facts: Stevens Point, Wisconsin"), is home to the University of Wisconsin-Stevens Point which has an enrollment of over 7,000 students ("Fast Facts"). Stevens Point is located in an area with many lakes and is situated along the Wisconsin River.

The City of Stevens Point operates a curbside composting program that serves the greater Stevens Point area. The program is operated in conjunction with two local

farms: Rising Sand Organics Cooperative Farm and Whitefeather Organics (risingsand.com). Rising Sand Organics is located 14 miles from Stevens Point in the town of Custer. Rising Sand Organics provides the logistical needs of the composting program by offering weekly or biweekly pick up of business or residential food waste. For residential customers, weekly pick-up costs $22.75/ month. For business customers, weekly pick-up costs $22/ month (risingsand.com). This monthly payment includes up to 50 pounds of waste, or 10 of the provided buckets. This fee structure has proven to be very successful in the Stevens Point program and has made it affordable for households and small businesses to participate. In the creation of a composting program in Oshkosh, a similar fee structure would promote active involvement from many small, area restaurants.

Waste is collected in designated five gallon buckets with screw tops by consumers which is placed on the curb along with trash and recycling dumpsters on scheduled days. The buckets are then transported by Rising Sand Organics using a wide-bed pick-up truck. Some short routes within the city are picked up by a bike with a small trailer attached (*Fig. 4*).

Figure 4

Rising Sand Organics also operates the public-facing side of the composting program. Their website hosts the sign-up and payment portal for new customers and they use their social media channels for communication about the composting program. Most notably, customers can look to their social media for information about what is appropriate to compost and what is not (*Fig. 5*).

Figure 5; Facebook caption: These tea bags are not acceptable through our curbside compost program. BUT you can empty out the tea leaves into your bucket instead!

After Rising Sand Organics Farm collects the compostable waste, Whitefeather Organics, located 12 miles outside of Stevens Point, composts the organic material using a windrow method (*Fig. 6*). This method is done outdoors and produces low amounts of heat and emissions, however it is time and

land area intensive. It takes about sixteen weeks to generate a usable compost product and requires many acres of space, especially for high volumes of waste.

Figure 6

The City of Stevens Point aided in the initial creation of the program by ensuring that all municipal codes and ordinances were friendly to curbside composting. The City also offered support in the planning process. Revenue and soil amendment that the program generates are for the use of Rising Sand and Whitefeather Organics. In 2020, Stevens Point's city-wide composting program diverted 30,000 pounds of food scraps from the landfill and 92,000 pounds of organic material of all kinds was composted (risingsand.com).

Potawatomi Bingo Casino Milwaukee, WI

One community that addressed food waste issues was the Forest County Potawatomi Community (FCPC). In 2013, they opened a new $20 million food waste biodigester facility at the Potawatomi Bingo Casino down in Milwaukee in response to the growing food waste problem. They were researching opportunities to mitigate their dependence on non-environmentally friendly energy. With that in mind, the Forest County Potawatomi Community wanted to produce their own green energy and searched for a feasible source to generate electricity. One of the abundant resources in the Milwaukee area was waste that's going to landfills or down drains. The FCPC faced a few challenges but the majority of them happened when they were working on the plans to build the biodigester facility. Oshkosh won't have to face these problems due to the fact that the biodigester is already built on the UW-Oshkosh campus. The main challenge that they have reported is greasy, oily, and fatty foods being digested which harms the mechanics and the biodigester system. The FCPC combated this issue by investing more money into the system so as to prevent the greasy, oily, and fatty foods from deteriorating the biodigester system. This causes their biodigester to be down for two months while the FCPC figured out a way to prevent this problem from happening and to make costly updates to their equipment. Oshkosh can learn from this by ensuring that the restaurants participating are strictly told which food wastes are allowed to go into their composting buckets. Having a set guideline for restaurants to follow on what can be composted will ensure that the biodigester system doesn't have any mechanical issues and put a pause on the composting program.

San Luis Obispo, CA

San Luis Obispo, California, a city of roughly 45,000 people, operates a dry anaerobic biodigester like the one in Oshkosh, WI. This biodigester is set to take in over 36,000 tons of waste every year from the residents of the city as well as the restaurants there and produces enough energy for over 600 homes. This process also creates more than 20,000 tons of high quality fertilizers that can be sold back to farmers for agricultural purposes and is set to reduce the amount of organic waste in landfills 75% by 2025. This is largely due to a state assembly bill in 2014 that required businesses that generated more than four cubic feet of organic waste weekly to implement a compost recycling program. This, along with residential composting programs around the San Luis area, have been implemented to help reduce the greenhouse gases being emitted. Residents can sign up for the “Green Waste Service" that is contracted through the San Luis Garbage Company. Once residents have signed up they are provided a smaller trash bin for solid compostable waste including yard waste, leaves, grass clippings, and food waste like meats, fruits, and vegetables. Businesses and restaurants are provided with a green dumpster that is for solid food waste only. The San Luis Garbage company then collects the compost from citizens and businesses weekly and transports it to the city’s biodigester. Oshskosh can learn from this by analyzing how much waste could be collected from the restaurants and the community. If a similar collection program was implemented, wastes being transported to landfills would be reduced as well as more power being generated for the campus and possibly the surrounding community. This could also increase the amount of fertilizer that could be produced by the biodigester and help make farming operations more sustainable in the Fox Valley area.

University of California Davis, CA

The University of California, Davis is another benchmarking example of a college campus using an anaerobic biodigester to produce energy for the school and surrounding area. This biodigester diverts over 20,000 tons of organic waste from landfills every year and turns 50 tons of that organic waste into over 12,000 kWh of electricity everyday. This biodigester is strategically located next to the University of California Davis landfill, which allows them to mix the gases produced by both the landfill and the biodigester, to produce over 5.6 million kWh of electricity every year reducing greenhouse gas emissions by 13,500 tons annually. Farming operations around this area also benefit greatly from this biodigester. Roughly 4 million gallons of fertilizers and soil amendments are produced annually which can provide natural fertilization for over 145 acres of farmland everyday. A problem in this process that UC Davis was trying to solve was the issue of transporting this fertilizer that has a short “shelf life.” The facility's digestate was inconsistent in texture and composition compared

to the traditional non biofertilizers and was causing logistical problems with the equipment that was already being used. However, through the process of filtering and drying the digestate it has made it possible for the fertilizer to last longer and be transported to farming operations that are farther away. This not only leaves sustainability implications for reduction of organic waste in landfills, the reduction of greenhouse gas emissions, but also the reduction of non organic fertilizers being used on farming operations.

The City of Oshkosh can benefit from this benchmarking example by examining the sustainability implications that increased biodigester operations have to offer. Expanding the campus biodigester on campus to intake more compost from the surrounding area could reduce the amount of organic waste being put in landfills effectively reducing the carbon footprint of the city, as well as providing greater amounts of natural fertilizers for the farming operations around the area.

Madison, WI (Program Failure but potential restart)

From 2011 to 2019, Madison, Wisconsin ran a pilot composting program where food waste was collected from both local restaurants and residential homes. Composting bins were provided to over 40 area restaurants and approximately 1,100 homes where collection would occur either weekly or every other week, Following collection, the food waste was hauled to the University of Wisconsin-Madison Agricultural Research Station where it was then composted using the windrow method. The pilot program experienced some levels of success, but ultimately had to come to an end due to contamination issues. Participants were either misinformed on what could be included in the composting bins, or failed to follow the procedure resulting in an abundance of plastic bags and utensils ending up in the collections. Also, paper products and napkins, which are compostable materials, would be laid out at the site to undergo windrow composting but would blow away in high winds that lead to littering and further pollution issues.

Although the program was deemed a failure and is no longer being carried out, our group was able to gain valuable information from Madison’s efforts. Their methods of collection seemed to work effectively and efficiently, picking up the compostable materials from participants' bins either every week or every other week, so we had a good understanding on how gathering could be implemented. In terms of their failures, we came to an understanding that contamination was the overwhelming issue, and a strong emphasis must be carried out in our proposal on what can and cannot be included in the composting bins. Furthermore, Madison’s method of windrow composting proved to have flaws with the composting of paper materials being that the wind caused substantial unintentional pollution. This led us to strictly focus on use of the

University of Wisconsin Oshkosh biodigester as our method of composting so that we could alleviate this area of pollution, and get the most out of energy productions by being able to include paper based materials in our composting.

Barriers

While the numerous benefits of a city-wide composting project are highlighted in this proposal, it is important to reflect on the barriers that may affect the roll-out of this project. Many of the barriers to this project were identified during stakeholder interviews. More specifically, restaurant owners gave insight on barriers that were specific to their own establishments. These identified barriers are not large enough to overpower the potential success of the program, however, and identifying these barriers early on is important to predict the direction in which the program will need to go.

This introductory, small scale composting initiative is not meant to be all encompassing. The goal is to create a relationship with trailblazing restaurants who want to do what they can to help the environment.

Kitchen Size

A common issue for these owners was that they do not have a space in their kitchen to house the compost bins. Due to the size of the composting bins, some restaurants may find they need to store theirs outside by their garbage dumpster. Restaurants such as Takiza Mexican and Mama's Noodle Bar expressed that as a common issue stating that their kitchens are very small and they wouldn't be able to keep these bins in their kitchen without them being in the way or properly tucked away so as to not interfere with their operations. One way to combat this barrier of kitchen size is to store these composting bins outside near their garbage dumpster. In the stakeholder interview with Brandon Nielsen, he indicated that if this were the case, the only ordinance that restaurants would have to comply with is Chapter 30, Article 7, Section 30-191 "Exterior Storage and Screening Standards". This ordinance states that all exterior trash storage areas shall be located within an enclosure at least 6 feet in height that completely screens the view of all trash and trash storage containers. This storage area must also be equipped with a solid gate to gain access to the storage area. Once since the majority of restaurants already have this exterior storage area, the composting bins can be stored within this storage area, causing no interference in the kitchen.

Fee Structure

Another barrier involving restaurants is the proposed fee structure. Several restaurants that indicated they would join the program also indicated that they did not want there to be fees associated with this service. These restaurants feel there should be no fees because they are the ones holding the responsibility of separating out the food waste.

City Labor Concerns

James Rabe also expressed similar concerns for kitchen sizes and the fee structure of the program. During his stakeholder interview, he also discussed the barriers of using the city and sanitation department as the food waste collectors. Currently, area restaurants are partnered with a third-party sanitation service that collects their waste. James Rabe stated that both the public works and the sanitation department are currently short staffed with their standing duties. If responsibilities related to the food waste collection program were added to either of these departments, they would need to hire additional employees which highlights another barrier of the funding for salary and benefits of more employees.

Contamination

The UWO biodigester runs on a 28-day cycle (“About Biogas Systems” 2020). This means that anything that goes into the biodigester must be able to break down within 28 days. When restaurants are collecting their food waste to be taken to the biodigester, anything they collect must break down in that time frame. Standard food scraps and paper products like napkins and paper towels easily break down in that amount of time. Materials such as Bioplastics (corn/wheat/etc.-based utensils, cups, straws, etc.), regular plastic, metal, glass, and other non-organic materials do not break down in 28 days. Since restaurants are collecting their own food waste, the risk of contaminating the biodigester with foreign materials exists.

To combat this issue, part of our recommended action is to provide restaurants with an educational pamphlet that clearly states what can and cannot be collected in their compost bins with specific examples. As part of the responsibilities of the City employee tasked with overseeing the program, ongoing information and education about contamination for the restaurants would help mitigate the amount of foreign materials that end up in the composting stream.

Significance for Sustainability

What will this proposal achieve for the city, and how does it advance goals of creating a more sustainable city? As we have discussed in class, there is no easy definition of sustainability. In this section, you need to lay out exactly how your proposal will lead to a more sustainable community, and why these proposals represent more sustainable choices. For example, what, specifically, are the sustainability benefits of energy conservation in private homes? What will this do to the city's carbon footprint? What are the social, economic, and environmental costs/benefits of this proposal (three pillars analysis). Explain how this project will advance sustainability goals beyond what the city was going to do anyway, as a part of standard operations and/or state requirements. Be as specific as possible in this sustainability analysis, and ground your discussion in research.

Expanding Waste Management

Based on an assessment of available research, solid waste management has evolved from no management tools whatsoever to complex systems that handle landfilling, incinerating and combustion, recycling, and composting. As countries move from developing to developed, they follow this model of solid waste management expansion. The most developed communities and municipalities in the United States operate a wide array of management facilities while others may facilitate only landfilling and recycling. Overall, waste volumes are increasing world wide and current solid waste management practices won't be able to keep up within the near future. Expansion of waste management to include comprehensive recycling services, material recovery, and composting systems will become necessary soon.

In recent years, disposal of municipal solid waste has increased, leading to an increase in pathogens present in landfills (Gerba 2011). Food borne illnesses, faecal matter, and absorbent sanitary products all contribute to overall pathogen populations. Food waste in particular contributes the most to faecal coliform (intestinal bacteria) populations. Based on the importance of pathogen reduction and public health, diversion of food waste is an important step in achieving sustainable waste management systems.

Transitioning from traditional methods of solid waste management and more sustainable ones has proved to be very difficult for many municipalities. There are barriers to greater sustainability in waste management, however analysis of each waste stream individually proves to be an effective way to transition (Pollans 2017). Solid waste management is composed of multiple components: landfilling, recycling, composting, etc. Reaching sustainability comes when modes for transitioning to more sustainable management practices are considered for each waste component.

Consideration of sustainability implications of directing waste through a composting system and waste deposited into landfills is a vital part of sustainable waste management systems. Through a case study at Kean University, Greenhouse gas emissions, eutrophication, smog formation, and fossil fuel use was found to be lower while also generating a profit for the university through sale of vegetables grown in the compost (Dongyan 2017). As a university that diverts food waste to a biodigester, their findings are applicable to the City of Oshkosh and could be replicated with the implementation of a restaurant composting program.

There are uniquely specific hurdles to implementing food waste management solutions that divert food waste from landfills. Some of these barriers include collection, hauling, storage, and bioconversion (Sindhu 2019). Despite these challenges, however, food waste-specific management solutions exist and are necessary practices within municipalities for a sustainable future. Community composting programs, biodigesters, and home composting campaigns can all be effective ways for municipalities to divert food waste. The benefit of value-added products can also be a compelling way to offset high cost barriers to implementation.

This research is relevant to implementation of a composting program within the City of Oshkosh because a majority of the research advocates for the necessity of food waste diversion. In order to make responsible use of land, responsibly produce emissions, and protect public health, municipal composting systems need to be implemented.

Negative Economic Impacts of Food Waste

With the United States being a developed nation, we have easier access to food, therefore making it that much easier for us to waste it. To understand the need for a better food waste management system in Oshkosh, we need to understand how unsustainable the food waste problem is here in the United States. More specifically, the food waste and improper disposal has key negative economic impacts from wasting money, and wasting a source of energy.

In 2013, a group of chemical engineering researchers at the University of Manchester conducted research and calculated food waste costs across the U.S., Japan, and the U.K. They estimated that each year in the U.S., at least 77 billion pounds of edible food, worth nearly $30 billion, is thrown away from restaurants, convenience stores, and supermarkets alone” (Melikoglu et al. 2013). It is the restaurants who are seeing this economic downside as David Blum from Walden University, Minneapolis, Minnesota who found that “the restaurant industry generated approximately 33 lb of food waste per $1,000 of a restaurant’s revenue” (Blum 2020). It is difficult to see so much economic loss that comes from the landfilling of food waste. Furthermore, these costs also extend to greenhouse gas emissions. Kumar Venkat, president of Clean Metrics Corp in Portland, Oregon, conducted research and found

that “avoidable food waste in the US exceeds 55 million metric tonnes per year, nearly 29% of annual production. This waste produces life-cycle greenhouse gas emissions of at least 113 million metric tonnes of CO_2e annually, equivalent to 2% of national emissions, and costs $198 billion” (Venkat 2011).

Not only is there economic loss associated with landfilling food waste, there is also a major loss of energy by discarding organic waste. In the same research project, Kumar Venkat computed the annual average energy content of food wastes in the United States from 2010, shown in *Table 1*. The calculated number for the United States is almost 495 petajoules. To put that into perspective, 495 petajoules of energy is equivalent to the electrical consumption of 4 million American houses over 1 year.

Country	Computed Average Energy Content, PJ
United States	494.7
Japan	119.0
Taiwan	103.3
United Kingdom	68.9
Korea	26.9
Singapore	3.6

Table 1. Computed Annual Average Energy Content of Food Wastes from Different Countries in 2010

Additionally, using food waste for anaerobic digestion produces methane rich biogas which can then be used for electricity as a renewable alternative to fossil fuels. Peter Stuart of Loughborough University found that using an anaerobic digester can produce usable methane as a renewable energy source to replace petrol to produce 1.7 kilowatt hours of electricity and heat. 1.7 kilowatt hours can produce electricity to the average American’s house for 1.4 hours (Stuart 2006).

Since these economic losses are primarily felt by the food industry, why does that matter for those outside of the industry? While the economic effects are one sided, the environmental impacts are felt by everyone.

Negative Environmental Impacts of Food Waste

One of the biggest environmental issues we face today is human induced destruction of natural lands, where landfills and food waste are a key contributor. Food waste is the second highest contributor to landfill wastes in the United States, where approximately 40 percent of all food produced is lost and accumulates in these dumps (Grossman 2020). These landfills lead to various different forms of environmental degradation. Soils become contaminated from the various chemicals breaking down and slowly decomposing, which experiences runoff from rain and ends up in surrounding water sources. But the key form of pollution that landfills lead to exists in

the atmosphere. In the United States, food waste in landfills accounts for roughly 16 percent of our methane emissions (Benson et al. 2018). Once these pollutants end up in the atmosphere, further issues arise and lead to environmental degradation in the forms of rising global temperatures and acid rain for just a few examples. As human populations continue to rise exponentially, food production simultaneously increases leading to more food wasted. The size and number of landfills will increase leading to further destruction of natural lands as areas are designated completely to dumping grounds, creating more dead zones and leading to even more of these various forms of pollution discussed. These forms of pollution and destruction of land all start with the unsustainable disposal of food wastes that build up in landfills causing nothing but harm to the environment. A change in action is evident, and this exists in the form of composting and biodigesting food wastes.

Biogas and Biodigesters

Mitigating the negative effects of various kinds of waste has become a sustainability issue that municipalities have been trying to solve. Food waste from citizens, agriculture, and grocery stores have been growing every year leading to increased input into landfills and pollution into our ecosystems. Renewable technologies like biodigesters have become a way to help mitigate these problems while also generating clean, renewable energy. Wisconsin is a particularly interesting place when it comes to the generation of energy considering a vast majority of their sources are from outside connections. Wisconsin also has many large scale agricultural operations and is a high producer of food and organic material. This outside dependency and large production of organic material opens the market for Wisconsin to invest in in-state energy production through renewables like biogas and biodigesters. A report done by Renew Wisconsin said that up to 6% of Wisconsin's energy needs could be met through biodigesters by collecting methane through the composting process. On top of this increased energy production, a serious investment nationwide into biodigesters and the biogas industry could produce 13,500 new biodigesters, over 335 thousand construction jobs, and over 23,000 new permanent jobs maintaining them (Tanigawa 2017). In other parts of the world there have been significant sustainability achievements by biodigesters as well. In lower income areas small, household biodigesters were set up to study reduction in physicochemical parameters and pathogens in water. The study found that biodigesters set up to mitigate household waste was successful in reducing pathogens like adenovirus, hepatitis A virus, salmonella and escherichia coli by over 90% from local waste waters and river waters (Lanna 1987).

A sustainable future may not be an easy feat to accomplish but places like Wisconsin are set up to be leaders in this field. A serious investment and better utilization of current biodigesters and biogas operations can have meaningful, lasting impacts on our environment. Wisconsin's energy productions could become less

dependent on outside sources and provide clean, renewable energy through the use of the waste we are already producing. Economically, a serious investment into renewables like biodigesters will create lasting jobs as well as an increase in green infrastructure. Lastly, biodigesters have the potential to reduce pollution not only from our landfills but also in our waterways and water supplies. Better utilization of the waste we produce will not only produce economic benefits but also environmental ones. Sustainable futures are only possible if we deal with the problems we have created.

Creating Sustainable Lifestyles

Living sustainably is imperative for the environment. Which is exactly what composting does by helping reduce waste in our landfills. The research ranged from studies about household composting attitudes to the behaviors of consumers on where they will eat out based on the restaurant's environmentally friendly practices. From the papers that I researched they did not primarily focus on local restaurants itself. Mainly on the attitudes and behaviors of living a sustainable lifestyle. It was somewhat challenging to find local restaurant specific research in regard to composting. But the overall message from the research I completed is that it is the same no matter if the restaurant is local or not. That through educating local area restaurants on the benefits that composting would have on the community. Which is what our proposal is about – to inform the restaurants that composting will have a positive outcome for the environment and community.

While conducting research on sustainable lifestyles, I found that changing the perception of what it means to live a sustainable lifestyle is that there is a perceived negative connotation to living this lifestyle (Gilg et al. 2005). The reasoning for this is because some believe they have to give up so much in order to live this way. But it is learning to adopt different practices over the years. There are different levels of living more sustainably which will impact an individual’s environmentally friendly decisions. An individual can be either altruistic and/or open to change. A lot of time those who live this type of lifestyle can be both (Samuelsson et al. 2008). The majority of my research concluded the importance of having early education on sustainability. With this paired with the support of family – it will help bring in awareness and a caring attitude towards the environment.

The concluding research on the attitudes about composting was on the relationship between environmental beliefs and the behavioral intentions on composting. Many factors play a role in how people perceive composting. Based on the advantages and disadvantages of composting. Paired with an individual internal perception vs. an external outside perception (Shirani et al. 2016). This is due to needing a specific skill set of prior knowledge and resources in order to succeed with composting. Many variables play a factor in the attitudes about composting.

Conclusion

Different composting programs around the country and in Wisconsin have proven to be successful in creating a more sustainable way to mitigate organic waste. Through these programs cities have seen reductions in the amount of waste being sent to landfills, reductions in the amount of greenhouse gases being emitted, an increase in the amount of electricity being produced for homes, and greater quantities of natural fertilizers being supplied to farming operations. We propose that expanding the biodigester program to include compost from local restaurants could help bring these benefits to Oshkosh. After surveying local restaurants to gage their interest in participating we found that 45.5% were interested in joining and were enthusiastic to share suggestions they had for the program. Surprisingly, we found that only 36.4% of respondents were not interested in the program due to the lack of benefits they would personally receive compared to the cost they would have. 18.1% of respondents were unsure about their ability to participate, but would reevaluate once they see the program finalized. These survey results show that a composting program is of interest to local businesses and could attract more participants after its implementation.

For participating restaurants we suggest a small fee around $40 a month for a weekly pick up and delivery of the compost based on the amount of compost that is produced by the business. This is modeled after the composting collection program that is being operated in Stevens Point, WI. The fees would cover the cost for the composting receptacles and the operational costs of the UW Oshkosh biogas collection service delivering the compost to the biodigester facility. We also suggest that a Composting Operations position be created through the city to help manage the program under the direction of Brad Spanbauer. This position would help with the day to day operations of the program as well as communicate with restaurants, provide education on the benefits of composting, and why this would be beneficial for the community. We believe that implementing this program would not only allow Oshkosh to decrease its environmental footprint but also provide clean energy and fertilizers for the surrounding area.

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