Keep Calm, Digest On

A Report of Anaerobic Digestion at Western Washington University

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ENVS 471
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Dec. 8, 2022

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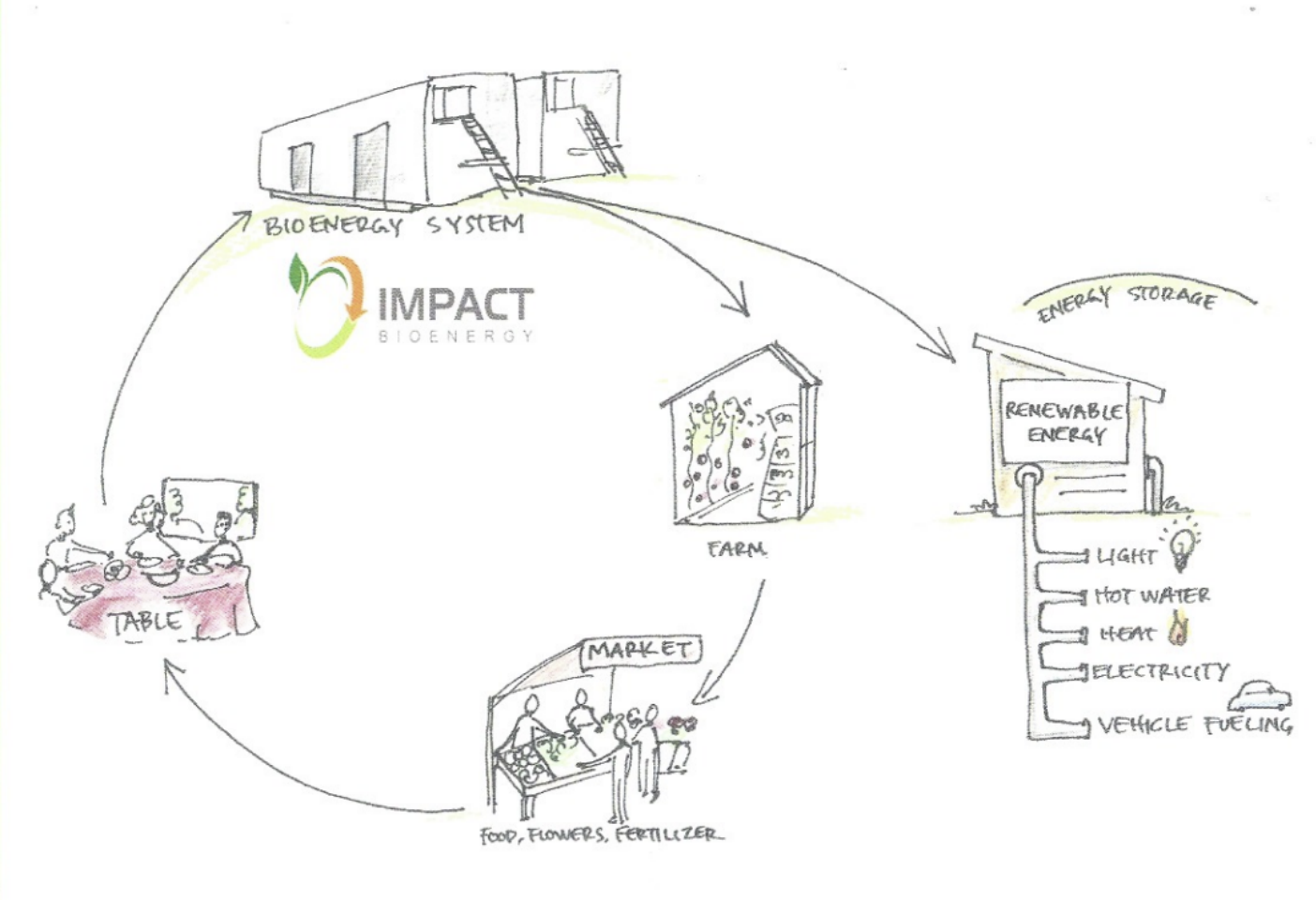
Figure 1

Impact Bioenergy anaerobic digestion



Note. Diagram of a circular economy from a Impact Bioenergy digester

Executive Summary

Problem Statement

To stay on track with the targets outlined in Western Washington University's Sustainability Action Plan, the University must begin to adopt different methods of energy generation and waste removal. Currently, the University relies on outsourcing for both heat, and waste removal. All of the buildings on campus are heated from a natural gas steam plant located behind the Ross Engineering Technology building and both food and solid waste are collected by the Sanitary Services Company (SSC).

This report investigates the possibility for implementation of an anaerobic digester which would create a closed loop system by turning food waste into usable forms of energy. Anaerobic digestion works as bacteria break down organic matter in an oxygen-free environment and produce biogas (a form of biofuel) and digestate (liquid fertilizer) as byproducts (Environmental Protection Agency, n.d.).

Biogas is mainly composed of methane (50-70%), carbon dioxide, hydrogen sulfide, water vapor, and other trace gasses. It can be used in mechanisms that natural gas is traditionally used in including heating systems, cooling systems, energy generation, etc. It can also be purified into Renewable Natural Gas (RNG) and used for things such as vehicle fuel (Environmental Protection Agency, n.d.). Digestate is made up of the leftover organic material from the digestion process (Environmental Protection Agency, n.d.). The digestate can be used as a soil conditioner/plant fertilizer that has a high value.

The ultimate objectives of this project are to save the University money by reducing the costs associated with waste removal transportation, reduce the carbon footprint of the University through alternative fuel sources and offsets associated with fertilizer production and sales, build lasting community relationships, and serve as a template for sustainability pursuits on other campuses.

Project Description

The goal of this report is to provide a feasibility study and recommended operational plan consisting of suggestions for the use of a prefabricated anaerobic digester, specifically the HORSE AD25 from the company Impact Bioenergy. The recommended operational plan includes: the exact location and placement, the staffing required for operation, the hours and times of operation, the equipment and utilities required, the use of the byproducts (biogas and digestate), the input of organic matter at the specific location, and the proposed funding source.

Summary of Recommendations

There are four identified recommendations for this project. Buying the HORSE AD25, leasing the Horse AD25, looking into implementation of the NAUTILUS, and looking into implementation of another, smaller anaerobic digester. The main recommendation is to buy the HORSE AD25 because through purchasing, the University or established businesses are able to profit off of the revenue generated through utilization of the byproducts, biogas and digestate. Another recommendation is to lease or lease-to-purchase the HORSE AD25 but will need to be further investigated in subsequent reports.

Figure 2
The HORSE AD25

Note. The smallest anaerobic digestion system from impact bioenergy.

Introduction

Statement of Need

Western Washington University's campus consists of three main dining halls that feed students from sixteen residence halls as well as some students that live off campus. The dining halls operate for breakfast, lunch, dinner, and late night dining services 7 days a week with closures for holiday breaks including Thanksgiving, Winter Break, Spring Break, and Summer Break. Together, the University dining halls produce roughly 30,000 lbs of organic food waste per week. This includes both pre and post-consumer waste and any material that can be commercially composted such as degradable napkins, tea bags, compostable flatware, paper products, etc. The calculation is based on an invoice provided by the Sanitary Services Company (SSC) which is the entity responsible for weekly pick ups at the separate dining hall locations (see Appendix A). SSC transports the compost to a third party commercial composting facility located in Lynden called Green Earth Technology.

Although Western diverts most of its food waste from the landfill via compost, this report investigates the option of anaerobic digestion to process the food waste more locally and potential uses for the byproducts. The scope of the paper is primarily focused on the feasibility and operations of implementing the HORSE AD25 which is an anaerobic digester produced by a company out of Auburn, WA called Impact BioEnergy. HORSE is an acronym for "High-Solids Organic-Waste Recycling System with Electrical output, and AD stands for anaerobic digester. The HORSE AD25 is roughly the size of a small shipping container and has the capacity to process 20-75 tons of food waste annually which translates into 960 weekly (*Horse AD25 Series,* n.d.).

The HORSE AD25 was chosen based on research conducted around anaerobic digestion from a previous Campus Sustainability Planning Studio (ENVS 471) class in Spring 2022. Their report (see Appendix B) looked at anaerobic digestion more generally and several options for digesters, as well as potential locations. After making initial contact with Impact Bioenergy in

Spring 2022, their suggestion for the next group of 471 students was to investigate the HORSE more thoroughly.

Upon selecting to research the operation of the HORSE AD25, the project team decided to focus on the location of the Fairhaven dining hall (also known as the Fairhaven Commons). Narrowing down the scope of anaerobic digestion and focusing on one manufacturer in one location creates the potential for a localized closed-loop system and the potential for a business plan involving various University and community partners.

Project Goals

This project is broken into three phases with this report being Phase I. The goals of Phase I are to devise an operational plan associated with implementation of the HORSE AD25 with logistics illustrated in the **Results** section and recommended options for next steps located in the **Recommendations** section. Logistics addressed in Phase I include a staffing plan, a cost-benefit analysis, and location and utility requirements. Based on this information, the project team recommends several different options for anaerobic digestion (AD) at the Fairhaven Commons.

Phase II of this project will be taken on by one of the group members Clara Copley for her Senior Project. In this phase, she will focus on finding an output for the digestate produced by the AD by working with farms in the community. Once a farm partnership is established, Clara will work to develop a business plan between the farm or farm coalition and the University. The business plan may also include a path to sell fertilizer commercially, apart from a partnership between the University and a farm. This aspect of Phase II will also bolster the cost-benefit analysis.

Another aspect of Phase II is to further investigate the logistics of utilization of the second byproduct from the AD, biogas. Phase II will work through how the output of Bio-CNG will be best served for the University. Options may include using this gas to provide heat for the Fairhaven Commons or another building on campus, storing it in fuel cylinders to transport to another location, and powering a generator that can be used to charge electric vehicles.

The final deliverable for Phase II is to begin working towards funding sources for the digester. Phase I of the report more thoroughly investigated purchasing the HORSE AD25 unit, but Phase II will also look at the option to lease it. Capital investment for obtaining and owning the digester is around $210,000 with extra capital investment for the first year of operations, rounding the initial investment to $300,000. The capital investment for leasing is around $35,000 (*UW Anaerobic Digestion)*. A cost-benefit analysis will be conducted to identify whether leasing or buying is the right fit for the University. Whether it will be bought or leased, funding will likely, at least in part, come from the Sustainability, Equity, and Justice Fund (SEJF)–a pool of funds accumulated through quarterly student fees accessible for student and faculty sustainability projects. Clara will begin to construct and write the abstract for an SEJF grant proposal. The goal for the SEJF is to use it as a primary funding source that will finance purchasing, implementing, and the first year or so of operations for the digester. The ideal amount of funding to be sourced from the SEJF would be around $300,000.

Phase III of this project will be pursued by another team member, Sienna Taylor. Sienna will continue the grant writing process as well as locating other potential funding sources, if necessary. She will also work on wrapping up the project and working to get the digester up and

running. This will include final operational logistics, staffing, etc. Many of her deliverables are contingent upon the completion and results from Phase II.

Background Research

To begin, research was conducted regarding anaerobic digesters that had been established on college campuses in the U.S. The project team looked at case studies to gauge the feasibility of anaerobic digestion at the university level. Case studies included: University of Washington, University of California San Diego, and Carnegie Mellon. Following an interview with Chief Inventor and CEO of Impact BioEnergy Jan Allen, there was an emphasis placed on the comparison of anaerobic digestion implementation at WWU and the process followed by Carnegie Mellon. At Carnegie Mellon, a student Dylan Lew, obtained the HORSE AD25 through a school sponsored grant and now sells the digestate through a business called Ecotone.

To determine the site of potential AD implementation, it was necessary to look at the amount of food-waste generated at each of the dining halls at WWU as well as accessibility to the digester, appropriate spacing accommodations, and locale in proximity to other important functions and considerations. Given these criteria, a focus was placed on examining the feasibility of the Fairhaven Commons. The Fairhaven Commons is located in South Campus and provides dining services primarily to students in the Fairhaven Residence Hall and Buchanan Towers. It is also around 1,000 feet from the Outback Farm which may be an output for generated digestate.

Additional research was conducted to quantify the type and quality of organic material from the Fairhaven Dining Hall that will be used to feed the digester. Aspects considered were the amount of waste daily and weekly, and a comparison of pre-consumer waste and post-consumer waste and which one, or both, should be utilized. A rough estimate of the quantity of waste, and the frequency and location of compost pick up was identified through examining an invoice billed to the University by SSC. It is important to note that SSC charges are based on frequency of pick-up, not the quantity. At the Fairhaven Commons, the compost is held in 2-cubic yard receptacles and is picked up twice a week. Assuming that the 2-cubic yard receptacles are full at the time of pickup, there would be around 4,000 lbs of food waste generated and transported weekly.

Methodology

The methodologies include both interviews and inventory assessments. Interviews have been conducted both on Zoom and in person, including physical site visits to the Fairhaven Commons. Communication with Amanda Cambre, the team project sponsor, involved weekly check-in emails and occasional Zoom and in-person check-ins. Since Amanda is the Director of Sustainability Integration for facilities and operations, she was able to answer many of the logistical and locational questions. Additional interviews were conducted with Jan Allen of Impact Bioenergy, Stephen Wadsworth of Aramark Dining, and Tim McLaughlin of the Fairhaven Kitchen. Jan Allen was addressed over Zoom with the project team, and Stephen and Tim were instrumental in answering questions relating to the daily dining hall waste, location of the digester, and operation.

The interview with Jan Allen, provided important information about the digester itself and information on staffing, cost, emissions reduction and benefit, utility logistics and other important information that is summarized in the **Results** section. Jan provided us with a typed Q&A document from our interview questions (see appendix C)

The inventory and benchmarking components of the methodologies include: quantity of waste, quality of waste, and bill tracking of organic waste outputs to SSC. Quantity of waste includes the amount in pounds of weekly organic waste from dining services, specifically the Fairhaven Commons. For the quality of the waste, inventory will be taken of the contaminants in the compost and how the amount of contaminants will impact the ability of the anaerobic digester to process the waste. The last category will be bill and cost tracking and analyzing. Analysis of how diversion of organic waste from SSC frees up funding for operations of the digester will be conducted to fulfill this last category.

Inventories and benchmarks were assessed to produce a cost-benefit analysis that included the current cost of food waste at the Fairhaven Dining Hall from SSC services, the cost reduction of that service with the installation of the HORSE, and the amount of food waste produced at the dining hall and the amount of food waste the HORSE can handle on a weekly basis.

Results

Staffing Plan

Staffing will be a collaborative effort from the Fairhaven kitchen staff and additional student(s) positions to run the digester. Kitchen staff from the Fairhaven dining hall currently transport the pre-consumer waste and post-consumer from the kitchen grinder and receptacles within the kitchen to a 2-cubic yard bin located on the loading dock that belongs to SSC and is picked up twice a week. There is a 64 gallon food waste receptacle located in the prep kitchen and a 32 gallon receptacle that captures the post-consumer waste from the built-in food pulverizer located next to the dish washing station. Both of these receptacles are emptied into the 2-cubic yard bin twice a day.

Figures 3, 4 & 5

Food receptacles at the Fairhaven Commons

Note. Figure 3: the 32 gallon receptacle for post-consumer organic waste, Figure 4: the 64 gallon receptacle for pre-consumer organic

waste, Figure 5: the 2-cubic yard receptacle for combined pre and post-consumer waste

If the HORSE is located in one of the parking spaces adjacent to the loading dock, it is recommended that the student operating position assists the kitchen staff in transporting the receptacle bins to the digester. There should be very minimal extra effort from the kitchen staff, their procedure should remain extremely similar to the current process. The transport of this material to the machine requires minimal effort (walking a few extra feet out the door) compared to the current practice of dumping the organic waste receptacle into the large bin located at the loading dock.

Operating the digester requires at least one part-time attendant at the machine. The hours of operation are recommended to be between the hours of 4-9pm. The Fairhaven kitchen fills up their in-kitchen vessels and empties them twice a day, once around 4pm and again around 8-9pm. Therefore, the HORSE would be fed around evening time. Jan Allen recommends the student run position part-time with only two to four hours per week to load food waste into the machine and another two hours per week should be budgeted for cleaning, datalogging, testing the digestate for pH,etc., and equipment care.

Location

The selected location for the anaerobic digester is behind the Fairhaven Commons building. The lot houses eight standard vehicle parking spaces, one for University vehicles, four accessible parking spaces, and three regular parking spaces. The HORSE AD25 requires 160 sq. ft. of space and a location that is mostly level, but with enough tilt to allow the water to drain through the floor. The HORSE weighs approximately 20,000 lbs that are supported at all four corners with the heaviest corner weighing 8,000 lbs (J. Allen, Personal Communications, Nov. 2, 2022).

Figure 6

Fairhaven Loading Dock

Note. This figure displays the physical space available in the loading dock behind the Fairhaven Commons. There are several general and accessible parking spaces, and designated motercycle parking.

Options for precise locations include relocation of an accessible parking spot from the northwest corner of the parking lot to the north end, which would reduce but not eliminate the existing motorcycle parking. Another option is for relocation of motorcycle parking from the north end of the lot to another location that is yet to be determined. It is possible to place a smaller digester on the west end of the loading dock where the current recycling receptacles are held. A smaller model and unit has not yet been identified but will be investigated in Phase II.

Other important location considerations are easy access to the digester by a vehicle. One of the byproducts of digestion, liquid plant food, needs to be emptied with a hose and a pump into a 275 gallon IBC tote on a truck (*HORSE AD25 series*, 2022). The frequency of this process will be dependent on the capacity at which the digester is running. The physical structure of the HORSE AD25 is a lockable, steel, 20' intermodal container that has the capability to last longer than 20 years (J. Allen. Personal Communication, Nov. 2, 2022).

Other possible locations will be addressed in Phase II of the project with possibilities including the AS Recycling Center lot which is located one block South of Campus.

Transportation

Due to the close proximity of the HORSE system to the Fairhaven Commons, transportation of the food waste to the digester will ensure little extra work for kitchen staff. The food waste can be transported utilizing one of two suggested methods. The first involves the use of small, five-gallon, containers which can hold roughly 40 lbs. each and will have to be manually lifted in order to be emptied into the food grinder. Another method utilizes 36-gallon sized wheeled recycling carts (toters) that may weigh up to 250 lbs. and will require the use of a mechanical (motorized) lifter to be emptied (A. Cambre. Personal Communication, Nov. 14, 2022).

Utilities

There are several utility requirements necessary for the HORSE AD25, including electrical, water, and sewer. A single phase 240 Volt AC circuit along with a 60 amp electrical service will be needed for food grinding, mixing, and heating processes (*HORSE AD25 series*, 2022). A standard garden hose faucet or irrigation pump is necessary for water supply for sanitation and housekeeping purposes (J. Allen. Personal Communication, Nov. 2, 2022). Additionally, a sewer connection will have to be installed to ensure proper separation of greywater (J. Allen. Personal Communication, Nov. 2, 2022). Other communication utilities or biogas transmission piping can be added upon request.

If the HORSE AD25 is placed in one of the parking spaces on the west side of the lot, the electrical hookup would likely come from an extension of the existing light pole (A. Cambre. Personal Communication, Nov. 14, 2022). Water and sewer are more uncertain but will be covered in Phase II or III.

General Operation

A wide array of food waste can be fed into the food grinder, gradually. This waste is then emulsified and made into a pourable and pumpable mixture. The input material must be the proper consistency, both pourable and pumpable, in order for the plumbing system to be

capable of recirculating the digestate back to the food grinder to help liquify dry food waste. The pulp from the grinder already in place in the Fairhaven kitchen will need to be liquefied and if not, the grinder is recommended to be forgone altogether. Other materials such as plastic, glass, or metal must be removed when loading waste into the grinder.

Summer Operation

During the summer months, the period of low food waste accumulation, it is recommended to continue to heat and mix the digester while maintaining a low input rate of about 50-100 lbs of food waste per week in order to keep the microbiome robust (J. Allen. Personal Communication, Nov. 2, 2022).

Cost-Benefit Analysis

The cost-benefit analysis looks at the current cost to Western to pay for Sanitary Services Company (SSC) for the removal of food waste from the Fairhaven Commons and compares it to the cost reduction of the long-term use of the HORSE AD25. Since the funds for the initial purchase of the AD will likely come from the SEJF grant, that is not included as a "cost" to the University at the moment. Additionally, long-term funding is likely to come from the sale of the fertilizer so the cost of long-term funding is not included in this primary analysis. The focus is on the cost saved to Western from the reduction of SSC services and the overall emissions reduced from the HORSE AD25.

Currently, SSC bills Western around $2,500 a year for organic waste removal only (not including other solid waste services) at the Fairhaven Commons. This is calculated based on the $237/month rate for a 2x week pickup and occasional fuel "surcharges." The sum is also based on an estimated reduction during summer months in which there is much less waste produced. Therefore, the amount of $2,500 is based on a 9 month cycle, not including the summer period between Summer and Fall quarter, and includes a buffer for additional surcharges as illustrated on the SSC bill (see Appendix A, image 3).

The Fairhaven Commons produces about 4-cubic yards of organic waste per week which is calculated based on the 2x weekly pickup of the 2-cubic yard receptacles at the loading dock. Based on a standard volume-to-weight conversion factor, one cubic yard of organic food waste weighs approximately 1,070 lbs (Volume-to-weight conversion factors). Multiplying this by four, means Fairhaven Commons produces about 4,280 lbs of organic waste per week.

The HORSE AD25 system is capable of handling 960 lbs of organic waste which could theoretically reduce SSC weekly pickups from the Fairhaven Dining Hall from twice a week to just once a week, assuming the 2-cubic yard receptacles are not regularly full at the time of pickup. Even though 960 lbs is not even half of the calculated waste generated, Stephen and Tim from Aramark alluded to the the difference of the room left in the 2-cubic yard, this would save the University roughly $1,250 per year based on the assumption that Fairhaven would reduce their SSC pickups to once a week.

a. **Emissions Reductions:**

Figure 7
HORSE AD25 carbon drawdown

Estimated Drawdown (Carbon Offsets)	
Digester Only	53
Digester + Indoor Farm System	208
liquid plant food output - gallons per week salable product	108
Wet Tons per Year	**25**
machine footprint (ft2)	160
realistic ground space (ft2)	240

Note. This chart outlines the estimated carbon drawdown from the HORSE AD25 including solely from the digester and from the production and sale of fertilizer (*HORSE AD25 series*, 2022).

The estimated carbon emissions "drawdown" from the HORSE AD25 digester would be about 53 MTCO2e per year. The University's annual emissions are around 10,000 MTCO2e per year for scope 1 & 2 of the energy portion of Western's emissions so the digester alone would have a minimal impact. However, the sale of the liquid fertilizer would allow funding to purchase other larger, durable, long term offsets. Not to mention the physical use of the fertilizer on Western's green spaces and the Outback Farm.

The AD produces around 100 gallons of fertilizer per week at max capacity and if there are 52 weeks in a year, that's about 5,200 gallons per year. If fertilizer was sold for $15 per gallon (which would likely be the wholesale rate considering retail liquid fertilizer from anaerobic digesters sell at around $19 per gallon on Amazon.com), the University would generate around $78,000 per year. Amanda Cambre assisted with these calculations based on her information about current University emissions and estimated that even a smaller revenue of $50,000 could reduce University emissions by 25%, or 2,500 MTCO2e by purchasing carbon offsets and funding further sustainability initiatives on campus (A. Cambre, Personal Communications, Nov. 10, 2022).

Recommendations

The HORSE AD25 model fulfills the needs of the University laid out in the Sustainability Action Plan. However, if the expenses incurred with this bigger system does not justify its implementation, other systems have been recommended that can fulfill a more robust cost-benefit relationship. Senior leadership at the University has expressed serious interest in some form of digester "...as it would support an educational enhancement on campus, further our sustainability mission, and could potentially be self-supporting…" (A. Cambre. Personal

Communication, Dec. 2, 2022), but will need more information on staffing plan and revenue potential before committing further (details to be addressed in Phase II and III).

The first alternative recommended option involves implementing a larger HORSE model or perhaps something even bigger, such as the NAUTILUS system. Also created by Impact BioEnergy, the NAUTILUS would be large enough to suspend SSC organic food waste services at the Fairhaven Dining Hall altogether (Distributed food waste to energy technology, n.d.). However, while the initial price of this larger system is also much greater than the HORSE counterpart, it would effectively save the University roughly $2,500 each year. The University also has the potential to profit from the sale of the digestate and use the revenue to invest further in sustainability initiatives and alternative carbon reduction measures such as air source heat pumps for buildings. Most of the carbon savings from the HORSE AD25 would likely come from offsets and alternative projects funded by the revenue of the digestate.

Furthermore, a third recommendation involves a smaller digester from an alternative company other than Impact BioEnergy which has not yet been identified but will be further investigated in Phase II. This digester would have to be smaller than 160 square feet which would allow it to fit on the loading dock behind the Fairhaven Kitchen. This option is suggested because the cost of purchase and installation of a larger system entails expensive and logistically complicated water, sewer, and electrical hookups.

Finally, the last recommended option is to lease the HORSE AD25 directly from Impact BioEnergy rather than buying it. This alternative comes from preliminary research that included observing the steps taken by the University of Washington when (UW) implementing their own anaerobic digester. Reasons given by UW as to why they chose to lease include making the project a trial rather than a permanent installment to save investment capital incase it is not a good fit with the University, and at the time of implementation, there was no entity that was willing to take over the operational costs of the digester (*UW anaerobic digester, 2017).* Furthermore, according to UW, leasing would cut implementation costs down to roughly $35,000 and Impact BioEnergy would be liable for any continued costs of the system.

Monitoring and Evaluation

Success of the project will be tracked utilizing the results from the cost-benefit analyses. If the results indicate that the anaerobic digester will be capable of producing a sufficient amount of clean energy and compost that will justify the amount of investment put into the project, success can be determined. These cost-benefit analyses will also provide insight into what staffing logistics will look like in the future and what staffing the system will need. From this, success can be determined by tracking whether the system is producing enough sustainable energy to justify part time or full time staffing and whether those positions are voluntary or paid.

Budget

Due to the extent and complexity of the project, the budget is likely to be sourced from multiple input pools. To begin, initial funding is projected to come from the Sustainability,

Equity, and Justice Fund (SEJF) that is made available for student and faculty projects through collection of student fees. The funds provided from the SEJF grant are likely to be used for the acquisition of the digester, transporting it to its new home on campus, and setting it up. It is still undetermined whether or not these initial funds will be budgeted for buying or leasing the system, this will be decided by the results of further cost-benefit analyses in future phases.

Estimated capital investments for the acquisition and implementation of the HORSE AD25 model are estimated to range from $200,000 - $600,000. While the sole cost of the digester is $210,000, Jan Allen recommended applying for a SEJF grant as much as $300,000 to allow for an operational budget for its first year in use. These costs would include: a paid part-time student position to run the digester, funds to retrofit the location in order to include sewer, water, and electrical hookups, purchasing a vessel that is capable of transporting liquid fertilizer on a campus-owned vehicle, and any other additional buffer funds. For this particular system, operating costs are expected to range between $4,300 and $21,000 annually once the device is up and running (*HORSE AD25 series*, 2022).

The process for grant writing is unlikely to fit into the timeline for this course and therefore is not included in deliverables. However, it will be continued on through the independent study projects of two students and will be addressed in Winter Quarter, 2023. Subsequent funding, following the first year of its use, would come from the sale of liquid fertilizer, additional SEJF grants, and other potential state and local funds. The details of setting up a business model for selling the liquid fertilizer will also be included in the work of the follow-up independent study projects.

Conclusion

Anaerobic digestion at Western Washington University, specifically through operation of the HORSE AD25 from Impact Bioenergy, has the potential to mitigate the University carbon footprint by creating a localized closed loop system of regenerating food waste into usable energy. The University could mitigate their cost and frequency of SSC pickups, offset carbon emissions through the production and sale of digestate, and provide an alternative to natural gas.

After completing this report it is evident that implementation of an anaerobic digester could be an important asset to the University to meet sustainability goals. It is important to continue research and further comparisons to determine if another option such as those listed in the recommendations section of this report are more viable and feasible for WWU specifically.

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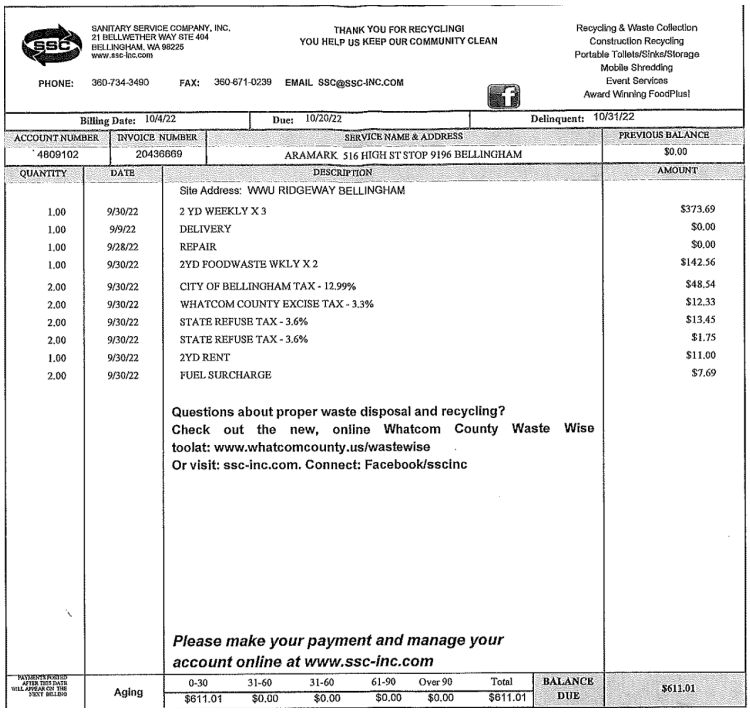
Appendix:

A. SSC Invoice



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Billing Date: 10/4/22 Due: 10/20/22 Delinquent: 10/31/22

ACCOUNT NUMBER	INVOICE NUMBER	SERVICE NAME & ADDRESS	PREVIOUS BALANCE
4809102	20436669	ARAMARK 516 HIGH ST STOP 9196 BELLINGHAM	$0.00

QUANTITY	DATE	DESCRIPTION	AMOUNT
		Site Address: WWU RIDGEWAY BELLINGHAM	
1.00	9/30/22	2 YD WEEKLY X 3	$373.69
1.00	9/9/22	DELIVERY	$0.00
1.00	9/28/22	REPAIR	$0.00
1.00	9/30/22	2YD FOODWASTE WKLY X 2	$142.56
2.00	9/30/22	CITY OF BELLINGHAM TAX - 12.99%	$48.54
2.00	9/30/22	WHATCOM COUNTY EXCISE TAX - 3.3%	$12.33
2.00	9/30/22	STATE REFUSE TAX - 3.6%	$13.45
2.00	9/30/22	STATE REFUSE TAX - 3.6%	$1.75
1.00	9/30/22	2YD RENT	$11.00
2.00	9/30/22	FUEL SURCHARGE	$7.69

Questions about proper waste disposal and recycling?
Check out the new, online Whatcom County Waste Wise toolat: www.whatcomcounty.us/wastewise
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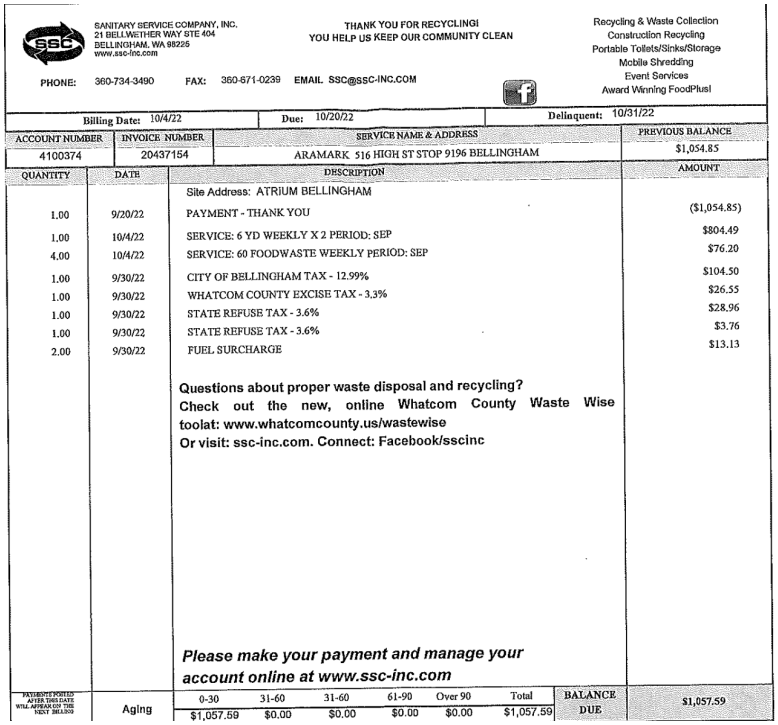
PAYMENTS POSTED AFTER THIS DATE WILL APPEAR ON THE NEXT BILLING

Aging	0-30	31-60	31-60	61-90	Over 90	Total	BALANCE DUE	$611.01
	$611.01	$0.00	$0.00	$0.00	$0.00	$611.01		



SANITARY SERVICE COMPANY, INC.
21 BELLWETHER WAY STE 404
BELLINGHAM, WA 98225
www.ssc-inc.com

THANK YOU FOR RECYCLING!
YOU HELP US KEEP OUR COMMUNITY CLEAN

Recycling & Waste Collection
Construction Recycling
Portable Toilets/Sinks/Storage
Mobile Shredding
Event Services
Award Winning FoodPlus!

PHONE: 360-734-3490 FAX: 360-671-0239 EMAIL SSC@SSC-INC.COM

Billing Date: 10/4/22 Due: 10/20/22 Delinquent: 10/31/22

ACCOUNT NUMBER	INVOICE NUMBER	SERVICE NAME & ADDRESS	PREVIOUS BALANCE
4100374	20437154	ARAMARK 516 HIGH ST STOP 9196 BELLINGHAM	$1,054.85

QUANTITY	DATE	DESCRIPTION	AMOUNT
		Site Address: ATRIUM BELLINGHAM	
1.00	9/20/22	PAYMENT - THANK YOU	($1,054.85)
1.00	10/4/22	SERVICE: 6 YD WEEKLY X 2 PERIOD: SEP	$804.49
4.00	10/4/22	SERVICE: 60 FOODWASTE WEEKLY PERIOD: SEP	$76.20
1.00	9/30/22	CITY OF BELLINGHAM TAX - 12.99%	$104.50
1.00	9/30/22	WHATCOM COUNTY EXCISE TAX - 3.3%	$26.55
1.00	9/30/22	STATE REFUSE TAX - 3.6%	$28.96
1.00	9/30/22	STATE REFUSE TAX - 3.6%	$3.76
2.00	9/30/22	FUEL SURCHARGE	$13.13

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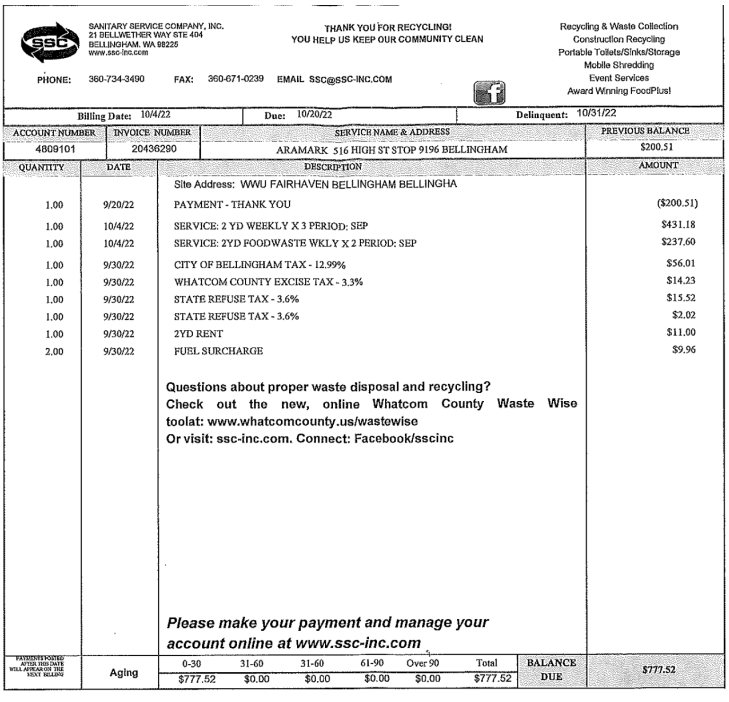
Aging	0-30	31-60	31-60	61-90	Over 90	Total	BALANCE DUE	$1,057.59
	$1,057.59	$0.00	$0.00	$0.00	$0.00	$1,057.59		



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ACCOUNT NUMBER	INVOICE NUMBER	SERVICE NAME & ADDRESS	PREVIOUS BALANCE
4809101	20436290	ARAMARK 516 HIGH ST STOP 9196 BELLINGHAM	$200.51

QUANTITY	DATE	DESCRIPTION	AMOUNT
		Site Address: WWU FAIRHAVEN BELLINGHAM BELLINGHA	
1.00	9/20/22	PAYMENT - THANK YOU	($200.51)
1.00	10/4/22	SERVICE: 2 YD WEEKLY X 3 PERIOD: SEP	$431.18
1.00	10/4/22	SERVICE: 2YD FOODWASTE WKLY X 2 PERIOD: SEP	$237.60
1.00	9/30/22	CITY OF BELLINGHAM TAX - 12.99%	$56.01
1.00	9/30/22	WHATCOM COUNTY EXCISE TAX - 3.3%	$14.23
1.00	9/30/22	STATE REFUSE TAX - 3.6%	$15.52
1.00	9/30/22	STATE REFUSE TAX - 3.6%	$2.02
1.00	9/30/22	2YD RENT	$11.00
2.00	9/30/22	FUEL SURCHARGE	$9.96

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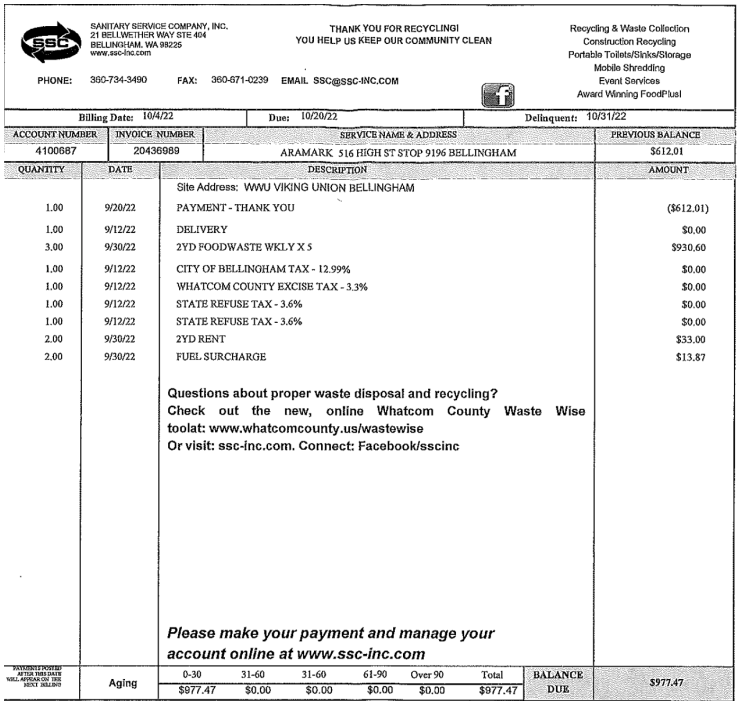
Aging	0-30	31-60	31-60	61-90	Over 90	Total	BALANCE DUE	$777.52
	$777.52	$0.00	$0.00	$0.00	$0.00	$777.52		



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ACCOUNT NUMBER	INVOICE NUMBER	SERVICE NAME & ADDRESS	PREVIOUS BALANCE
4100687	20436989	ARAMARK 516 HIGH ST STOP 9196 BELLINGHAM	$612.01

QUANTITY	DATE	DESCRIPTION	AMOUNT
		Site Address: WWU VIKING UNION BELLINGHAM	
1.00	9/20/22	PAYMENT - THANK YOU	($612.01)
1.00	9/12/22	DELIVERY	$0.00
3.00	9/30/22	2YD FOODWASTE WKLY X 5	$930.60
1.00	9/12/22	CITY OF BELLINGHAM TAX - 12.99%	$0.00
1.00	9/12/22	WHATCOM COUNTY EXCISE TAX - 3.3%	$0.00
1.00	9/12/22	STATE REFUSE TAX - 3.6%	$0.00
1.00	9/12/22	STATE REFUSE TAX - 3.6%	$0.00
2.00	9/30/22	2YD RENT	$33.00
2.00	9/30/22	FUEL SURCHARGE	$13.87

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Aging	0-30	31-60	31-60	61-90	Over 90	Total	BALANCE DUE	$977.47
	$977.47	$0.00	$0.00	$0.00	$0.00	$977.47		

B. Anaerobic Digestion feasibility study from Campus Sustainability Planning Studio Spring 2022

C. Q&A from conversation with Jan Allen, Impact Bioenergy