



SUBMITTED TO THE USF STUDENT GREEN ENERGY FUND COUNCIL

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USF CAMPUS FOOD WASTE RECOVERY PROJECT

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Table of Contents

| | | |
|------|---|----|
| I. | Introduction..... | 3 |
| II. | Background..... | 4 |
| | Figure 1. EPA’s Food Recovery | 4 |
| | Figure 2. Anaerobic Digestion Cycle and Components | 6 |
| | Figure 3. Anaerobic Digestion Biochemical Process | 5 |
| | Figure 4. Anaerobic Digester and Gas Collection | 5 |
| | Figure 5. Municipal Solid Waste Composition | 5 |
| | Figure 6. United Nations Sustainable Development Goals (SDGs) | 10 |
| III. | Project Objectives & Sustainability Plan..... | 11 |
| IV. | Implementation Plan and Projects..... | 15 |
| | Table 1. Future Vision Plans for Larger Scale Anaerobic Digestion | 17 |
| V. | References..... | 19 |
| VI. | Other Figures and Tables | |
| | Figure 7. Partners in the Campus Food Waste Recovery Project | 21 |
| | Table 2. Projects and USF responsible parties | 22 |
| VII. | Appendices | |
| | Appendix A. OPS Student Responsibilities | 24 |
| | Appendix B. Budget | 25 |
| | Appendix C. Project Timeline & Important Dates | 27 |
| | Appendix D. Long-term Sustainability plan – Letters of Support | 28 |
| | 1. USF Facilities | |
| | 2. USF Aramark/Dining Services | |
| | 3. USF Feed-a-Bull Pantry | |
| | 4. USF Athletics | |
| | 5. USF College of Public Health | |
| | 6. USF Department of Civil and Environmental Engineering | |
| | 7. USF Patel College of Global Sustainability | |
| | 8. USF Department of Anthropology | |
| | 9. USF Department of Sociology | |
| | 10. USF Department of Religious Studies | |
| | 11. USF Social Marketing Group, College of Public Health | |

I. Introduction

On November 14, 2017, University of South Florida faculty, staff, and students met for the first time at the Rosebud Continuum to discuss a potential campus food waste/recovery initiative on campus. Sparked from a discussion at the “From Farm to Landfill: What Can Communities do to Promote Sustainable Food Systems” event in April 2017 (picture below, supported by the USF Sustainable Research Food Collaborative and the Tampa Bay Network to End Hunger), a group of passionate USF leaders connected to do more for the USF campus moving forward. The group now consists of USF faculty, staff, and students representing the Office of Global Sustainability, Dining Services/Aramark, Botanical Gardens, Facilities, Athletics, Social Marketing Group, Patel College of Global Sustainability, and the Colleges/Departments of Anthropology, Engineering, Public Health, Sociology, and Religious Studies.

The purpose of this project is to pilot test a scalable program that will provide the USF community a place to support food recovery initiatives such as reducing food waste and utilizing food and other organic wastes to generate renewable energy sources. While the short-term goal is to incorporate methods that can divert food waste into renewable resources such as through anaerobic digestion on the USF campus - the broader vision is one of sustainable food systems for our communities.

For a greener University of South Florida campus...



II. Background

Up to 40% of the food produced in our country winds up in landfills instead of being eaten (Environmental Protection Agency [EPA], 2015). It is reported that college campuses as a group waste about 22 million pounds of food each year (Poon, 2015); this number breaks down to an average of 142 pounds per student living on campus and 38 pounds per student living off campus (Recycle Works, 2018). Additionally, the Urban Institute found that about 11.2 to 13.5 percent of America's college students are food insecure, meaning these students lack the resources to be able to obtain adequate food, which negatively impacts academic performance, health, and mental health (Blagg, Gundersen, Schanzenbach, & Ziliak, 2017). Unfortunately, this statistic is similar to our national rate of food insecurity of 12.3% among households in the U.S. (EPA, 2015), and 13.9% in Hillsborough County (Feeding America, 2018). Although the USF campus has the Feed-a-Bull pantry, there has been no baseline assessment to identify the current situation of food insecurity on campus nor has there been campus-wide efforts to measure the extent of the food waste problem. Thus, there should be an assessment that identifies student needs and how to promote a better food system on USF campus.

Figure 1. EPA's Food Recovery Hierarchy



Food waste is the discarding or alternative (non-food) use of food that is safe and nutritious for human consumption along the entire food supply chain (Food and Agricultural Organization of the United Nations [FAO], 2014). Food recovery is the process of preventing and diverting wasted food, or using food waste in other ways before it ends up in our landfills (EPA, 2017). According

to the EPA's Food Recovery Hierarchy (Figure 1), the two most preferred methods of food

recovery are source reduction and feeding hungry people. USF Aramark Dining Services currently implements their Green Thread Environmental Sustainability program, which includes source reduction methods such as tray-less dining and the LeanPath program that shows students how many pounds of food are wasted to encourage food waste prevention behaviors. USF Aramark also donates edible, pre-consumer food that has not been used to local charities through contracting with the Food Donation Connection. In addition, Aramark disposes of post-consumer food waste to be composted by partnering with Bay Mulch. However, this arrangement is limited in the amount and type of food that can be donated, and Aramark has not been able to renew the next contract that they need with the composting site. Therefore, the food waste at the 20+ dining sites on campus are

not being recovered efficiently. The disadvantages of the current described methods include:

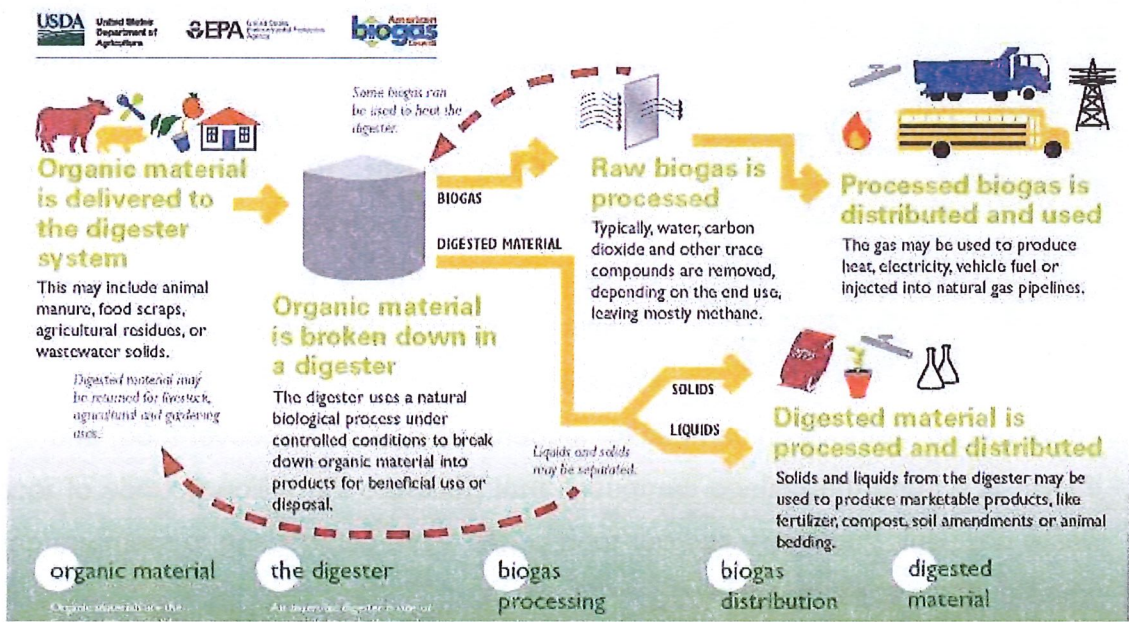
Methane gas is a more potent greenhouse gas than carbon dioxide. The diversion of food waste from going to the landfill will result in carbon footprint reduction by using anaerobic digestion (AD). By using AD, methane would be captured and as a result, would not be released into the atmosphere.

1. Financial and energy costs are incurred from waste disposal and food donation (transportation, time, money, etc.);
2. Food waste recovery adopting the aforementioned practices are only from one dining hall, with limited recovery from Einstein's Bagels to support Feed-a-Bull pantry several times a week;
3. There are no methods on campus for students who want to recover food; and
4. If USF is among the college campuses that generate 22 million pounds of food waste per year, then we – and our food waste – are contributing to methane gas emissions into the atmosphere.

Anaerobic digestion (AD) is a process where organic material is broken down by microorganisms in the absence of oxygen. Figure 2 is a simplified version of AD explained by the United States Department of Agriculture (USDA), Environmental Protection Agency (EPA), and Department of Energy's Biogas Opportunities Roadmap Report in 2014. This process occurs naturally in the environment and similarly inside a stomach to

which the food enters the digestive track and is broken down. Specifically, there are several steps in the process to fully break down the material. The main steps are hydrolysis, acidogenesis/fermentation, acetogenesis, and methanogenesis (Adekunle and Okolie, 2015). Figure 3 shows additional details on the AD biochemical process. During these processes, microorganisms break down the food into simpler molecules such as sugars and acids. Other break the sugars and acids into gases such as methane and carbon dioxide while producing a solid or liquid nutrient rich fertilizer that can be used as a soil additive (Frigon and Guiot, 2010). The methane can be used to produce heat and electricity (Chynoweth et al., 2001). To store the methane to use later, it can be captured and stored in a gas bag (Figure 4). The two outputs of the AD process include clean and environmentally friendly methane biogas and fertilizer.

Figure 2. Anaerobic Digestion Cycle and Components



For the scope of this project, the team will assess the feasibility of using the biogas and fertilizer produced during the AD process on campus. Some options being explored include: fuel for fleets of golf carts and other machinery for USF Grounds, and cooking fuel for campus events and demonstrations. We propose to assess the quality of the

fertilizer for use on USF Grounds and campus recreational sites, which may have additional environmental benefits.

Figure 3. Anaerobic Digestion Biochemical Process

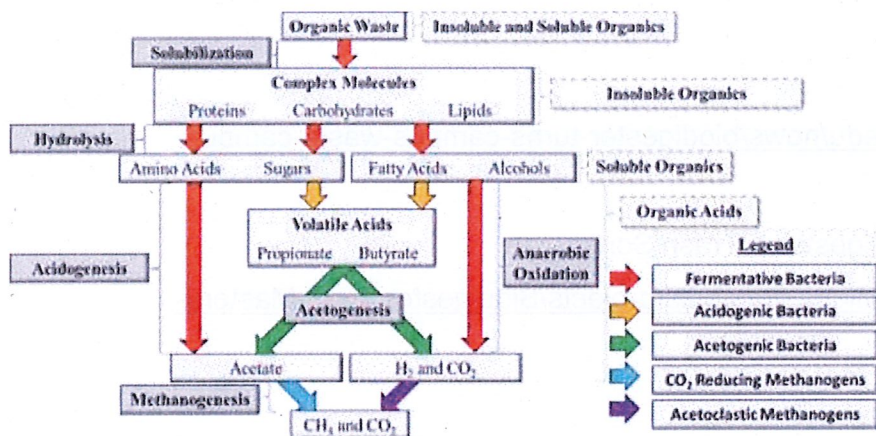


Figure 4. Anaerobic Digester and Gas Collection



Humans have used anaerobic digestion (AD) for hundreds of years. Benefits of AD include (PennState Extension, 2018):

- Local: cost savings from the production of renewable energy and transportation/disposal of food waste, preserved nutrients in the form of usable fertilizer
- Regional: potential pathogen reduction of land applied nutrients
- Global: reduced H₂ and methane emissions and dependency on fossil fuels

Figure 5. Municipal Solid Waste Composition

In the United States, municipal solid waste is primarily disposed of in landfills (53%) or processed at incineration waste-to-energy facilities (13%). Within this waste stream, food waste (15%) and green waste (20%), also referred to as yard waste, make up some of the largest components; see

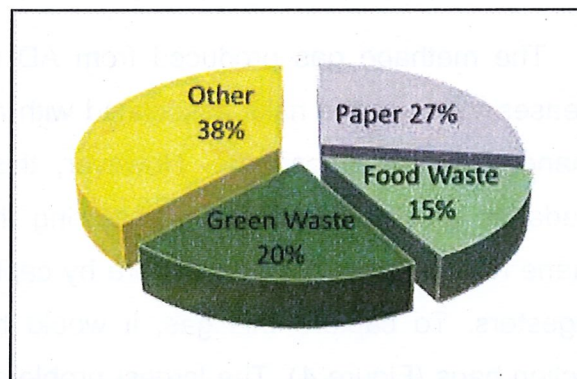


Figure 5 (EPA, 2015). The conventional disposal methods have limited capacities or are

being phased out, which accelerates the necessity for better management of solid waste (EPA, 2015), which makes anaerobic digestion worthy of exploration.

Using AD on campuses is not a new idea. Some of the other examples are included in the following list:

- UC Davis, California
 - <https://www.ucdavis.edu/news/biodigester-turns-campus-waste-campus-energy>
- University of Michigan (Biodigester & Trash Sort)
 - http://sustainability.umich.edu/media/projects/Biodigester_Dow-Masters-2016.pdf
- Michigan State University
 - <http://msutoday.msu.edu/news/2013/new-msu-anaerobic-digester-to-supply-power-for-south-campus-buildings/>
- Princeton, Living Laboratory announced November 2017
 - <https://sustain.princeton.edu/sites/sustainability/files/Biodigester%20RQs.pdf>
- McGill Office of Sustainability – Feasibility Study
 - <https://www.mcgill.ca/sustainability/biodigester-feasibility-sp0082>
- University of Wisconsin Oshkosh (Sanimax recycling)
 - <http://www.uwosh.edu/today/20925/cant-clean-your-plate-no-problem-uwo-sanimax-help-community-feed-the-biodigester/>

The methane gas produced from AD reactors is at a low pressure. This fact decreases many of the risks associated with natural gas use except for the leaking of methane into the atmosphere. However, this process occurs naturally through the degradation process. The act of collecting the biogas would reduce the amount of methane released into the atmosphere by capturing 100% of what is released from the biodigesters. To capture this gas, it would be contained in portable bottles or gas collection bags (Figure 4). The largest problem with successful biodigester operation is the risk of the pH dropping below 6.0 (acidification) and temperature changes

(biodigesters do not operate efficiently in cold temperatures). However, the Tampa, Florida climate does not pose significant problems, and experts have noted that it is not complicated to “re-start” the digestion process if the bacteria become dormant during the winter. For this project, the funding accommodates purchases for baking soda and other necessary supplies to use as a solid phase alkalinity source to buffer the reactor’s pH to remediate acidification, if needed. Also, the biodigester team will continually monitor the progress and productivity of the digesters with measurements throughout the course of the project.

As good stewards of our campus and our environment, we should recover food because it:

- Reduces waste by recovering perfectly, edible food to support hunger-relief efforts;
- Reduces waste volume at the landfill (post-consumer waste); and
- Diverts methane gas from being released into the atmosphere.

We propose this project in the hopes that food recovery can increase student engagement and interest in the local food system. The goals of this project are timely because it falls in line with USF’s sustainability efforts including the Climate Action Plan that President Judy Genshaft signed in 2008 which is a national campaign “to assemble institutional pledges to neutralize greenhouse gas emissions, and to accelerate higher education’s research and educational efforts to equip society with the information and tools to re-stabilize the earth’s climate,” (USF News, 2008) as well as other university-level sustainability reporting efforts such as the Sierra Club Cool Schools ranking and the STARS report.

Food recovery also promotes sustainability and environmental awareness among students and our campus. Our goals align with the larger, global Sustainable Development Goals (SDG); see Figure 6. This project will address: campus and community hunger with recovered food from dining sites so that resources (energy, water, soil, etc.) used to produce this food is not wasted [SDG 2]; good health and well-being

which works to ensure that all students have access to food if they are in need by supporting the Feed-a-Bull pantry [SDG 3]; clean, renewable energy generated from the biodigesters in the form of methane gas [SDG 7]; promoting responsible consumption and disposal of food to prevent food waste and recovering when possible [SDG 12]; and reducing gas emissions that could harm the climate by reducing transportation that would be needed for food waste (and potentially yard waste on campus) disposal and diverting food waste from the landfill to the biodigesters [SDG 13].

Figure 6. United Nations Sustainable Development Goals (SDGs)



III. Project Objectives & Sustainability Plan

This project proposes to divert food waste from the landfill, which will support local hunger-relief efforts and reduce methane gas emissions. This would provide an innovative component to potentially garner credits in the AASHE STARS report, which is a sustainability tracking, assessment, and rating system for universities and colleges. Although food recovery and sustainability efforts are present on other campuses, food waste is currently not incorporated in the USF Campus Recycling and Energy Conservation Program nor are there food recovery efforts on campus that would generate renewable resources. This means that this project can be incorporated into USF's sustainability efforts to be included in the STARS report. This project proposes food recovery that remains on campus or within the local area to support charities, supported by faculty and staff, and reduces the carbon footprint in a closed loop system within USF campus. That is, food purchased by Aramark will be consumed by campus consumers, food waste will be recovered to support the USF Feed-a-Bull pantry and/or anaerobically digested to generate renewable energy at the biodigester sites, which will then be used on USF campus and grounds as an energy source. The future vision would be that the campus can use the renewable energy generated for various purposes and scaled up to recover all food waste on campus. *Goals of this project include:*

- Reducing food waste at the source to minimize methane gas emission,
- Recovering food waste to support food insecure students and community members, and
- Reusing food waste to generate renewable energy sources (liquid organic fertilizer and clean biogas that can be potentially used for electricity, heat, cooking fuel, converted to diesel, etc.).

USF Facilities (Tom Schlick), is willing to invest in the project using the cost savings generated by the methane biogas and fertilizer production. If this project proves that there is a cost benefit and shows a reasonable return on investment (provided at the end of the pilot test), USF Facilities is willing to scale the project to accommodate

more food waste. Furthermore, USF Aramark has agreed to provide all the food waste needed for the project, which reduces the need to transport materials to the landfill and reduces USF's carbon footprint further. With the larger biodigesters, more food waste and yard waste would then be able to be digested on campus. With increased output of biogas and organic fertilizer, costs would decrease from the biogas as an alternative fuel source and reduce the need to purchase fertilizer and chemicals for grounds maintenance.

The expertise and interdisciplinary nature of this group provides a unique strength in combining cutting edge experience with social benefits specifically for students and a more sustainable and environmentally friendly campus. As mentioned previously, our project team is supported and carried out by a group of faculty, staff, and students that represent the following USF entities: Dining Services/Aramark, Facilities, Athletics, Feed-a-Bull Food Pantry, Office of Sustainability, Botanical Gardens, Social Marketing Group, Patel College of Global Sustainability, and the Departments of Civil and Environmental Engineering, Anthropology, Sociology, Public Health, and Religious Studies.

While students are essential to this project and will carry out the logistics, our project is promising because permanent USF entities are willing to incorporate our vision and proposal. This pilot study is to test the feasibility and scalability of a campus food waste recovery program. The project team (hired students) with guidance from the advisory committee will be responsible for all proposed project tasks in 2018-2019. When the project is complete, the team will present the deliverables (described in the next section IV. Implementation Plan and Projects) to the USF entities that are willing to invest and lead the efforts. Throughout the duration of the pilot test in 2018-2019, the project team will work with the entities to provide the transition plan so that the USF entities can take over the project and merge with existing programs such as Aramark's Green Thread Sustainability program and the USF Campus Recycling and Energy Conservation program.

Benefits of this project

We see many benefits for this project and hope to continue exploring even more. Listed below are the most significant benefits that are prioritized for this project:

1. Carbon Footprint and Energy Reduction

- a. The diversion of food waste going to the landfill; by using anaerobic digestion (AD), methane would be captured and would not be released into the atmosphere.
- b. With four pilot anaerobic digester units, each digester site would need to be fed every other day. For example, food waste would be put into A and B on Monday, then C and D on Tuesday, and back to A and B on Wednesday. This gives the biodigester time to breakdown the food waste and not overload. Each of the biodigesters would be able to accommodate 10 gallons of food waste per day per feeding. This equates to a total of 20 gallons of food waste to be used to feed the reactors per day. However, since the food waste will be mixed with water, the mix will be 50% wet mass of food waste. In other words, 20 gallons *7 days per week =140 gallons per week /2 (for 50% capacity) =70 gallons food waste = 560 pounds food waste per week (gallons converted to pounds). Using a rough estimate with the University of Texas waste carbon calculator (University of Texas at Austin, 2016), approximately 41.5 net carbon emissions in metric tons of CO₂ equivalent will be captured with this estimated amount of food waste diverted. As part of the project, composting yard waste from the campus recreational facilities will be mixed with food waste. This would ideally scale up in the future, in terms of increasing capacity of food and yard waste to be diverted.
- c. The reduction of transportation of food waste through the AD process will reduce costs to pay for transport, disposal, etc. as well as the reduction of energy through diesel-fueled trucks.

2. Student Well-Being and Engagement

- a. Campus engagement opportunities promote student learning in meaningful ways, which students can give back and contribute to their campus environment. This project is one example where it can promote student engagement by providing hands-on experiences and learning

opportunities that will transfer to the real-world. Student engagement literature is increasingly being shown as a protective factor to address problems such as low achievement, boredom and alienation, and high dropout rates (Fredericks, Blumenfeld, & Paris, 2004). One objective of this project is to conduct a baseline survey to assess student awareness of food sustainability issues and to develop a social marketing campaign to prevent and reduce food waste and increase food recovery among students. The vision for this project is to engage students to care about their campus sustainability and environment. The social marketing campaign will directly educate students to increase their knowledge about the environmental impact of food waste and to adopt positive behaviors such as recycling of food and other items.

- b. Food recovery to support Feed a Bull pantry which directly impacts food insecure students on USF campus. The more food we can recover, the more we can divert from the landfill. The more support we can provide to the pantry, the more social and physical resources we can use to build capital. Additionally, there is a student organization on campus called the Food Recovery Network. We hope and plan to work with this student group to increase food recovery, which provides additional student engagement and service opportunities.
- c. We want to build a culture that supports student-driven sustainability initiatives. This project includes student education and campus outreach to promote increased awareness of our climate, environment, and health which indicate the need for sustainable solutions. We propose a project that is promising to deliver these components.

3. Cost savings & Return on Investment (ROI)

Cost savings include the reduction of the following:

- a. Cost to dispose food waste – amount to be determined
- b. Costs to dispose yard waste (USF Facilities and Athletics) - \$10,000

- c. Costs for grounds maintenance/ purchase of chemicals and fertilizer (USF Facilities and Athletics) - \$75,000
- d. Renewable technology and potential savings costs – to be determined

IV. Implementation Plan and Projects

Figure 7 and Table 2 describe the roles of the project collaborators and the implementation plan of this project. There are three distinct phases and four projects that will occur simultaneously. Project phases include implementation, evaluation, and student impact assessment. Each are briefly described below.

Implementation

The implementation phase will occur in the following steps: 1. Food waste recovered to provide food donations to Feed-a-Bull pantry or local charities (food recovery support is already in place via the Tampa Bay Network to End Hunger's Waste No Food app which the PI is a part of) and inedible, post-consumer food waste will be recovered to the four biodigesters being proposed to be built on USF campus. The four pilot sites will be located at OPM100 (2), USF Botanical Gardens (already built), and USF Athletics area near the tennis courts. There will also be one compost site (at OPM100 and managed by USF Facilities; currently in place with plans to expand) to compare the feasibility of both options. The composting site will also be used for the pretreatment of yard waste to allow it to be anaerobically digested more efficiently. USF Facilities has already been approved to operate the biodigesters at their facility through the space impact form. Design of the biodigesters is provided by USF professor Dr. Thomas Culhane and in partnership with anaerobic digestion experts in the College of Engineering.

The project team will hire three OPS students (see Table 1 for student interdisciplinary team and responsibilities) to maintain the logistics of the food recovery to transport, recover, and facilitate the processes. We have arranged with USF Dining Services to recover food only at locations on the USF Tampa campus to recover food

for the pilot test. Thus, students will work with Dining Services staff to coordinate a pick up schedule and transport edible or inedible food to charities or campus biodigesters.

Deliverables:

- Standard Operating Procedures (SOP) for picking up/dropping off food waste to the digester in coordination with Aramark and Facilities staff
- Materials and cost list for campus food recovery implementation
- Transition plan to incorporate food waste recovery into USF Campus Recycling Program and Energy Conservation bins

Evaluation

The technical team (students from Patel College and Engineering) will test the safety, efficacy, and productivity of the biodigesters with guidance from faculty advisors and the committee. They will also design and carry out the campus food waste audit that will provide some guidance to measure food waste on campus.

Deliverables:

- Safety and efficacy report for biodigesters
- Capacity and productivity report for biodigesters
- Results of campus food waste audit
- Standard Operating Procedures/protocol for conducting a campus food waste assessment and transition plan to capture food waste into the USF Grounds annual waste report

Student Impact Assessment

This aspect of the project incorporates the social and campus responsibility to engage students and promote environmental awareness and relies on the faculty and staff from the social sciences and humanities (Social Marketing Group, Public Health, Anthropology, Sociology, and Religious Studies). The team will design and conduct a student awareness survey (only fall 2018 to determine student attitudes and knowledge about food systems, conduct a formative evaluation to develop a social marketing

campaign to reduce campus food waste (only spring 2019), and carry out a food recovery marketing campaign on USF campus (only summer 2019).

Deliverables:

- USF Baseline assessment survey of student awareness, knowledge, and interest in food insecurity, food waste recovery, nutrition, and recycling
- Social Marketing plan for a Zero Waste Campus initiative
- Student impact assessment of social marketing plan

Table 1. Future Vision Plans for Larger Scale Anaerobic Digestion on USF Campus and Greater Tampa

| Phase | Timeline | Action/purpose | Responsible parties | Costs | Scale |
|-----------------|------------------|--|---|---------------------|---|
| Pilot – Phase 1 | Summer 2018-2019 | USF Dining Services food waste > 4 biodigester sites + 1 composting site >>> organic fertilizer and biogas used by USF. Grounds, Athletics, & Botanical Garden | Project Team All Departments & Entities (Sociology, Anthropology, Public Health, Engineering, Patel College, USF Athletics, Grounds/Facilities, Aramark, USF Social Marketing Group) | Requested from SGEF | Pilot test, IBC tank digesters to accommodate 8 gallons of food waste per double digester > 16 gallons per day > 896 gallons per week |
| 2 | | USF Dining Halls food waste recovery to campus biodigesters | Led by USF Aramark & Grounds USF Social Marketing Group – continual evaluation (student receptiveness, food waste contamination, etc.) | | 9’x9’ ceramic digesters = 55 gallons per day |
| 3 | | Greater campus food recovery with USF Facilities recycling program | Led by USF Grounds/Facilities Monitoring/Evaluation? | | Landfill scale |

Since this is a feasibility study to potentially scale up an anaerobic biodigester on campus, Table 1 describes the potential for each level of scale and the possible pathway to be able to take for future projects. The vision of this project would be that there be no food waste and all food waste from all facilities as well as waste generated from home could be recovered on campus using AD that will be managed by USF Facilities.

In conclusion, we envision this project to be instrumental in supporting current USF sustainability efforts with significant impact on promoting student wellness, environmental awareness, and campus engagement about an important, local and global issue. This interdisciplinary project involves faculty, staff, and students that provides a promising step towards a truly, greener campus.

On behalf of the whole project team, we thank the USF Student Green Energy Fund Council for the opportunity to share our ideas.

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Figure 7. USF Partners in the Campus Food Waste Recovery Project during Implementation, Evaluation, and Evaluation Stages

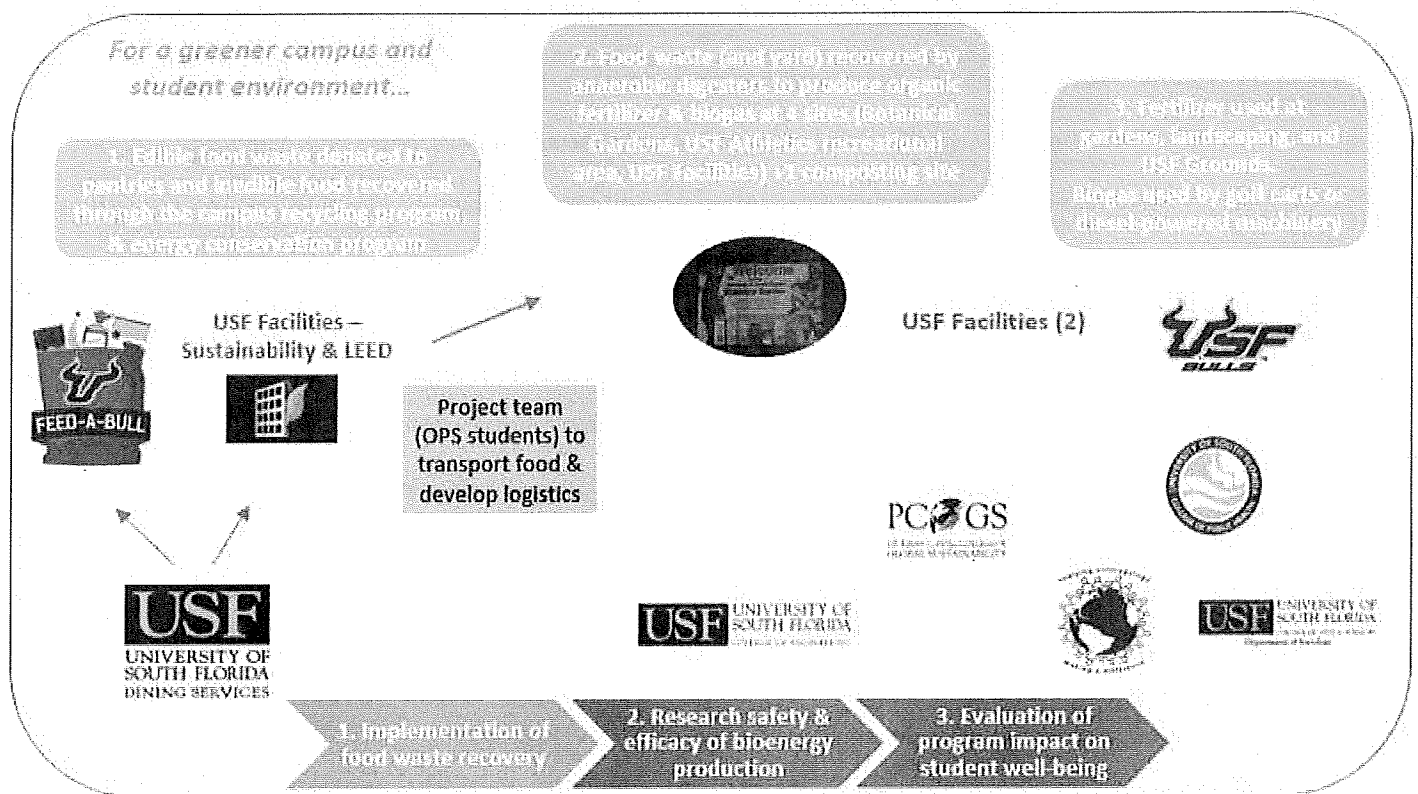


Table 2. Projects and USF responsible parties

| Projects | Questions to be answered | Responsible parties |
|---|---|--|
| 1. Productivity, feasibility, and safety of biodigesters (4) & composting site (1) | 1. What are the amounts of: food waste that can be put in; methane gas produced; and fertilizer produced (and what is this equivalent to compared to purchased fertilizer)? 2. What are the optimal conditions at which the biodigester runs (temperature, water concentration, etc.)? 3. What are safety precautions that should be considered during large scale implementation? | <ul style="list-style-type: none"> • Patel College • Engineering • USF Facilities • USF Botanical Gardens • USF Athletics |
| 2. Identify student awareness, interest, and knowledge on food insecurity(FI), waste, and production [BASELINE DATA] | 1. What is student knowledge of FI and food waste? 2. To what extent do students experience FI? 3. What is student awareness of food system resources on campus (botanical garden plots, etc.)? 4. What is student interest in food production and waste reduction and recycling behaviors? 5. To what extent are students willing to participate in campus recycling and energy conservation programs? | <ul style="list-style-type: none"> • Anthropology • Sociology • Public Health |
| 3. Conduct campus food waste audit | 1. How much food waste is generated by campus facilities (Marshall Student center, dining hall, etc.)? 2. What is the total amount of food waste and portions by food group? 3. What are students' reasons for having leftover food on their plates? | <ul style="list-style-type: none"> • Patel College • USF Aramark • Sociology • Public Health |

| | | |
|---|--|---|
| <p>4. Conduct formative evaluation using baseline data and create social marketing plan to educate students about food insecurity on campus and food waste prevention/reduction</p> | <p>1. What topics are students most interested and willing to participate in (related to food systems and recycling)?</p> <p>2. What educational tools/platforms will students be most receptive to learn about sustainable food systems?</p> <p>3. Are there tools that can reduce food waste on campus, e.g., Sustain-A-Bull app to calculate carbon footprint?</p> <p>4. What is the impact of the social marketing campaign?</p> | <ul style="list-style-type: none"> • Prevention Research Center/Public Health • USF Aramark |
|---|--|---|

Appendix A. OPS Student Responsibilities for 5-hour Work Week; Three Total Student Hires

| | | Patel College | Engineering | Public Health (Volunteers) | Anthropology | Sociology (Volunteers) |
|--------------------|--|------------------|------------------|----------------------------|------------------|------------------------|
| Implementation | All students will be responsible for transporting food from dining site to biodigesters. This will include weighing, grinding, and feeding the digesters. Students will also have to report and log information (electronic data entry) for each site. | 2 hours per week | 2 hours per week | | 2 hours per week | |
| | Maintenance of biodigesters | 1 hour per week | 1 hour per week | | | |
| | Outreach and education of the project | Volunteer | Volunteer | Volunteer | Volunteer | Volunteer |
| Evaluation | Test safety, efficacy, and productivity of the biodigesters. | | 1 hour per week | | | |
| | Research, design, and carry out campus food waste audit. | 1 hour per week | | x | | |
| Student Assessment | Design and conduct student awareness survey (only fall 2018). | | | x | 2 hours per week | |
| | Formative evaluation for social marketing campaign (only spring 2019). | | | x | 2 hours per week | |
| | Carry out food waste reduction and recovery marketing campaign on USF campus (only summer 2019). | | | x | 2 hours per week | |
| Admin | Project team meeting | 1 hour per week | 1 hour per week | | 1 hour per week | |
| | Total hours for each student = 5 hours per week | | | | | |

Appendix B. Budget

| Materials | Cost | Purpose |
|--|------------|---|
| 12 month 5 hour per week Student OPS (3) Undergraduate: \$9/hour, Masters: \$16/hour Doctoral: \$21/hour | \$12,100 | Based off 5-hour OPS student positions with OPS fringe and life insurance. This total amount is based off 1 undergraduate student (\$2,361), 1 Master's student (\$4,191), and 1 Doctoral student salary (\$5,499). |
| Biodigester parts | \$4,000.00 | Four pilot sites to build double IBC tank anaerobic biodigesters; space impact form has been approved and submitted by USF Facilities. |
| Food recovery/donation materials | \$1,500.00 | Food safety materials (bags, refrigerator-if needed to supplement Feed-a-Bull pantry, 5-gallon buckets (25), etc.), transportation of food waste |
| Social Marketing curriculum and educational materials | \$2,000.00 | Vinyl banner, curriculum, printouts/handouts, incentives Design cost of materials (\$500 honorarium) |
| Campus food waste audit materials | \$500.00 | Scales, technology/app development, etc. |
| Outreach materials (signs, flyers, demonstration items, etc.) | \$500.00 | To promote food recovery "how to", our project, and SGEF |
| Food for meetings or focus groups/forums/educational trainings (5 advisory meetings, 10 FGs) | \$500.00 | \$30 each meeting (\$450) plus serveware |
| Lab testing materials (nutrient chemical analysis, mass balances of food waste, vials, etc.) | \$4,000.00 | Test input and output of biodigesters to compare with organic composting pile and feasibility to substitute with chemical fertilizers |
| Miscellaneous (maintenance of biodigester, materials, garbage disposal/grinder, gloves, etc.) | \$500.00 | |

| | | |
|---|-----------------------------|---|
| Faculty, staff, & GA time (not paid from SGEF) | In-kind | Advisory board & collaborators & gas in-kind |
| USF Engineering Lab | In-kind | |
| Hunger Action Alliance – Advisory services & community support and connections | In-kind | Through Dr. David Himmelgreen, Chair and Professor in Dept. of Anthropology |
| Transportation of recovered food (golf carts, etc.) | In-kind from USF Facilities | |
| Total requesting for phase 1 (2018-2019): \$25,600.00 | | |
| Phase 2 to build larger biodigesters: \$10,000.00 <u>(NOT requesting in this proposal)</u> | | |

Appendix C. Project Timeline & Important Dates

| | Fall 2018 | Spring 2019 | Summer 2019 |
|--|-------------|-------------|-------------|
| Start pilot project and present to Deans | If approved | | |
| Hire OPS students | X | | |
| Outreach to greater campus about SGEF project and food recovery goals | X | X | X |
| Project 1. Productivity, feasibility, and safety of biodigester (Patel & Engineering) | | | |
| Build and maintain pilot biodigesters | X | X | X |
| Finalize data collection methods and protocol | X | | |
| Collect & report data | X | X | X |
| Project 2. Identify student awareness, interest, and knowledge on food insecurity, waste, and production [BASELINE DATA] | | | |
| Conduct literature reviews, finalize data collection methods and protocol | X | | |
| Collect & report data | X | X | X |
| Conduct campus food waste audit | | | |
| Project 3. Use baseline data to inform formative evaluation, then conduct formative evaluation and create social marketing plan to educate students about food insecurity on campus and food waste prevention/reduction | | | |
| Conduct literature reviews, finalize data collection methods and protocol | X | X | |
| Carry out social marketing plan & conduct campus food recycling/ waste reduction trainings | | | X |

Appendix D. Long-term Sustainability plan – Letters of Support

12. USF Facilities
13. USF Aramark/Dining Services
14. USF Feed-a-Bull Pantry
15. USF Athletics
16. USF College of Public Health
17. USF Department of Civil and Environmental Engineering
18. USF Patel College of Global Sustainability
19. USF Department of Anthropology
20. USF Department of Sociology
21. USF Department of Religious Studies
22. USF Social Marketing Group, College of Public Health

May 1, 2018

Dear Student Green Energy Fund Council:

I am writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. I am the Assistant Director of Services for USF Facilities Management. I oversee the Campus Recycling Program and also manage all 880 acres of USF Grounds. I see great potential in this project to provide potential cost savings through the biogas and fertilizer production.

If the project is funded, I am willing to take leadership and commitment in the potential scale up of this project. As proposed, the one-year project is a pilot test and the project team will coordinate the logistics of food waste distribution to the three campus biodigester sites.

I currently manage a composting site and am willing to oversee the addition of these proposed two double-tank biodigesters. I can commit to working closely with the project team and USF Dining Services to manage campus food waste as planned in the proposal.

Based on the findings of the pilot test, I am willing to explore the potential cost savings and look into investing in the up scaled project with the other campus entities listed in the project proposal including USF Athletics and USF Dining Services to share expected costs.

I fully support and commit to seeing the success of this project carried out. Feel free to contact me at tshlick@usf.edu.

Sincerely,



Tom Schlick
Assistant Director, Services
USF Facilities Management



June 20, 2018

Dear Student Green Energy Fund Council:

I am writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. I, Jessica Cicalese, Marketing Director from USF Dining Services, and I, Paul Mack, Director of Operations from USF Dining Services, are willing to assist the project through USF Dining Services. We see great potential in this project to provide cost savings and promote campus sustainability by reducing food waste.

If the project is funded, we are willing to commit to providing USF Dining Services food waste and assisting with the logistics needed from the USF Dining Services team/staff. As proposed, the one-year project is a pilot test and the project team will coordinate the logistics of food waste distribution to the three campus biodigester sites. We are committing to responsibilities that include:

- 1) Coordinate logistics for the USF Dining Services staff to collect food waste from various Dining locations across campus to be determined.
- 2) Project Team will be responsible for the delivery of collected waste to the biodigester sites.
- 3) Develop a plan to work with USF Feed-a-Bull and other community food pantries to donate unserved food to reduce food insecurity on campus and the surrounding neighborhoods.
- 4) Assign pilot dining sites on campus needed to conduct campus-wide food waste audits.
- 5) Assist the team to provide data from the LeanPath Track to support the food waste audit.

We fully support and commit to seeing the success of this project carried out. Please feel free to contact us at mack-paul@aramark.com and Cicalese-Jessica@aramark.com.

Sincerely,

Paul Mack

A handwritten signature in black ink, appearing to read "Paul Mack", written over a white background.

Director of Operations

USF Dining Services

Jessica Cicalese

A handwritten signature in black ink, appearing to read "Jessica Cicalese", written over a white background.

Marketing Director

USF Dining Services

May 14, 2018

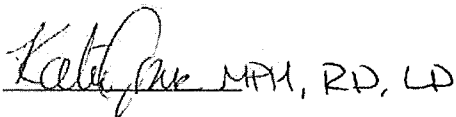
Dear Student Green Energy Fund Council:

I am writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. Representing Feed-a-Bull, the USF campus food pantry, I, Ms. Katie Jones, will serve on the committee to facilitate the partnership with USF Dining Services to recover edible food to reduce food insecurity on campus. If the project is funded, I am willing to provide the following:

- 1) Serve as the Feed-a-Bull liaison and relay USF pantry needs and preferences;
- 2) Assist the project team in coordinating logistics with USF Dining Services to utilize edible, recovered food to support the Feed-a-Bull pantry; and
- 3) Provide guidance for the campus-wide baseline assessment survey to understand student awareness and knowledge of food insecurity on campus.

Without reservation, I fully support and commit to seeing the success of this project carried out. Feel free to contact me at kjones3@health.usf.edu

Sincerely,

A handwritten signature in black ink that reads "Katie Jones MAH, RD, LD". The signature is written in a cursive style with a horizontal line underneath the name.

Katie Jones

June 12, 2018


Dear Student Green Energy Fund Council:

I am writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. I am the Sports Turf Manager for the USF Athletics department and I see great potential in this project to provide potential cost savings through the fertilizer production.

If the project is funded, I am willing to partner and assist in the potential scale up of this project. As proposed, I am willing to explore the potential cost savings of yard waste and fertilizer and look into investing in the upscaled project with the other campus entities listed in the project proposal including USF Facilities and USF Dining Services to share expected costs. I am also willing to take on an advisory role to assist in the biodigester and nutrient analysis of the fertilizer product to explore the potential of using it on campus recreational facilities.

I fully support and commit to seeing the success of this project carried out. Feel free to contact me at scottgrace@usf.edu.

Sincerely,

A handwritten signature in cursive script, appearing to read "Scott Grace".

Scott Grace

USF Athletics



May 23, 2018

Dear Student Green Energy Fund Council:

We are writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. Representing the College of Public Health, I, Dr. Jennifer Marshall, will serve as a Faculty Advisor for the project to assist with and guide project development, data collection and analysis, interpretation and reporting, and I, Dr. Russell Kirby, Distinguished University Professor, will serve on the Advisory Committee as a resource for the students.

The project is well-planned, with tremendous support and buy-in from faculty and staff across campus and highly capable students. Our role in this project is to provide guidance by using Public Health concepts, principles, and methods for effective research and practice. If the project is funded, I am willing to provide the following:

- 1) Provide advice and guidance in the project design and methods
- 2) Assist the team in developing a campus-wide baseline assessment survey to understand student awareness, knowledge, and interest of sustainable food systems on campus
- 3) Recruit and advise graduate and/or undergraduate Public Health student(s) who will assist with the project
- 4) Facilitate connections and partnerships, if possible, with campus and community entities such as the USF Sustainable Food Research Collaborative

Without reservation, I fully support and commit to seeing the success of this project carried out throughout the pilot project and beyond. Feel free to contact us with any additional questions or for further information.

Sincerely,

DocuSigned by:
Jennifer Marshall 5/23/2018
F093127537B441D...

Jennifer Marshall, PhD, MPH
Assistant Professor, Department of Community and Family Health, College of Public Health, University of South Florida
USF Sustainable Food Research Collaborative Chair
Tel: 813-396-2672
Email: jmarshal@health.usf.edu

DocuSigned by:
Russel Kirby 5/23/2018
E22088825494A8...

Russell S. Kirby, PhD, MS, FACE
Distinguished University Professor and Marrell Endowed Chair, Department of Community and Family Health, College of Public Health, University of South Florida
Tel: 813-396-2347
Email: rkirby@health.usf.edu

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COLLEGE OF PUBLIC HEALTH • DEPARTMENT OF COMMUNITY AND FAMILY HEALTH
Mailing Address: 13201 Bruce B. Downs Blvd. MDC56 • Tampa, FL 33612
Physical Address: 13301 BRUCE B DOWNS BOULEVARD, NEC 255, Tampa, FL 33613
(813) 396-2672 • FAX (813) 905-9998 • jmarshal@health.usf.edu



UNIVERSITY OF
SOUTH FLORIDA

Civil & Environmental Engineering
University of South Florida
4202 East Fowler Avenue, ENB 118
Tampa, Florida 33620-5350
(813) 974-2275

April 27, 2018

Letter of support for USF Campus Food Waste Recovery Proposal to Student Green Energy Fund

To whom it may concern,

I am writing this letter in support of the proposal by Whitney Fung, Li Zhu, Phillip Dixon, & Gviana Goldberg to USF's Student Green Energy Fund on the topic of Food Waste Recovery. I am a professor and graduate program coordinator in the Department of Civil & Environmental Engineering at USF. My research focuses on Environmental Biotechnology, with applications in wastewater treatment and waste-to-energy technologies. I have been serving as a faculty advisor for the team, specifically in the area of biodigesters for production of biogas and fertilizer from campus food waste. If the project is funded, I will help make it a success through the following:

- 1) Assist the team in the design, operation and monitoring of the proposed pilot-scale biodigesters.
- 2) Recruit and advise graduate and/or undergraduate Environmental Engineering student(s) who will assist with monitoring, scale-up, economic and life cycle assessment aspects of the project.
- 3) Make laboratory space, equipment and training available for system monitoring.
- 4) Facilitate interactions with solid waste management staff in the City of Tampa, Hillsborough County, Florida Department of Environmental Protection and local engineering consulting firms in order to examine system scale up and design of a regional co-digestion facility.
- 5) Facilitate interactions with manufacturers of combined heat and power (CHP) systems (e.g. GE), biodiesel from biogas (e.g. T2C-Energy), or other companies to explore potential biogas uses.

I look forward to working with the team on this project.

Sincerely,

A handwritten signature in cursive script that reads 'Sarina Ergas'.

Sarina Ergas
Professor and Graduate Program Coordinator
Civil & Environmental Engineering

May 14, 2018

Dear Student Green Energy Fund Council:

We are writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. Representing the College of Public Health, I, Dr. Thomas Henry Culhane, will serve as one of the faculty advisors for the project. My role in this project is to provide guidance by using Patel College of Global Sustainability concepts and principles. If the project is funded, I am willing to provide the following:

- 1) Provide advice and guidance in the project design and methods
- 2) Assist the team in building bio digesters equipped with all the sensors in four different sites on campus.
- 3) Record all the data from the sensors and work with engineering department to utilize the function of bio digester
- 4) Assist the team conducting food waste audit.
- 5) Recruit and advise graduate Patel College of Global Sustainability student(s) who will assist with the project

Without reservation, I fully support and commit to seeing the success of this project carried out. Feel free to contact us at thculhane@usf.edu.

Sincerely,

A handwritten signature in black ink, appearing to read "Thomas H. Culhane", followed by a long horizontal line extending to the right.

Dr. Thomas Henry Culhane



UNIVERSITY OF SOUTH FLORIDA

September 18, 2018

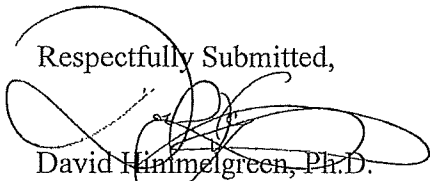
Dear Student Green Energy Fund Council:

I am writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. Representing the Department of Anthropology, I, Dr. David Himmelgreen, will serve as one of the faculty advisors for the project. My role in this project is to provide guidance by using Anthropology concepts and principles. If the project is funded, I am willing to provide the following:

- 1) Provide advice and guidance in the project design and methods
- 2) Assist the team in developing a campus-wide baseline assessment survey to understand student awareness, knowledge, and interest of sustainable food systems on campus
- 3) Recruit and advise graduate and/or undergraduate Anthropology student(s) who will assist with the project
- 4) Facilitate connections and partnerships, if possible, with campus and community entities such as the USF Hunger Action Alliance.

Without reservation, I fully support and commit to seeing the success of this project carried out. Feel free to contact me at dhimmelg@usf.edu .

Respectfully Submitted,



David Himmelgreen, Ph.D.
Professor and Chair

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FAX (813) 974-2668 · www.cas.usf.edu/anthropology



May 21, 2018

Dear Student Green Energy Fund Council:

We are writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. Representing the Department of Sociology, I, Dr. Jennifer Friedman, and I, Dr. Laurel Graham, will serve on the committee as a resource for the students. Our role in this project is to provide guidance by using Sociology concepts and principles. If the project is funded, we are willing to provide the following:

- 1) Provide advice and guidance in the project design and methods
- 2) Assist the team in developing a campus-wide baseline assessment survey to understand student awareness, knowledge, and interest of sustainable food systems on campus
- 3) Assist the team in the development of a campus food waste audit
- 4) Recruit and advise graduate and/or undergraduate Sociology student(s) who will assist with the project

Without reservation, we fully support and commit to seeing the success of this project carried out. During the Summer A 2018 session, Dr. Friedman will teach a course in Sociological Research Methods" (SYA 3300) in which some students will collect data on campus food waste to provide helpful initial data for this project.

Feel free to contact us at jfriedman@usf.edu and lgraham2@usf.edu.

Sincerely,

A handwritten signature in black ink, appearing to read "JFriedman", written over a light blue horizontal line.

Jennifer Friedman

A handwritten signature in black ink, appearing to read "Laurel Graham", written over a light blue horizontal line.

Laurel Graham



September 1, 2018

Dear Student Green Energy Fund Council:

I am writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. Representing the Department of Religious Studies, I, Mr. Dell deChant, will serve on the committee as a resource for the students. Our role in this project is to provide guidance by using Religious Studies concepts and principles. If the project is funded, we are willing to provide the following:

- 1) Provide advice and guidance in the project design and methods
- 2) Assist the team in developing a campus-wide baseline assessment survey to understand student awareness, knowledge, and interest of sustainable food systems on campus
- 3) Facilitate connections and partnerships, if possible, with campus and community entities such as the USF Sustainable Food Policy Research Group.

Without reservation, I fully support and commit to seeing the success of this project carried out. Feel free to contact me at dechant@usf.edu .

Sincerely,

A handwritten signature in black ink, appearing to read "Dell deChant", written in a cursive style.

Dell deChant
Associate Chair and Master Instructor



June 14, 2018

Dear Student Green Energy Fund Council:

I am writing this letter in support of the USF Campus Food Waste Recovery project proposed by Whitney Fung, Li Zhu, Phillip Dixon, and Gviana Goldberg to USF's Student Green Energy Fund. Representing the College of Public Health, and specifically Social Marketing at the University of South Florida, I will serve as a faculty advisory and will serve as a resource for the students. Additionally, I plan to involve students from my Introduction to Social Marketing class in helping to conduct the formative research for the proposed project. Other guidance that I am willing to provide include:

- 1) Provide advice and guidance in the project design and methods
- 2) Assist the team in developing a campus-wide qualitative formative research survey to understand facilitators and barriers, the place where student wish to receive information and how they would like to receive it.
- 3) Recruit and advise graduate and/or undergraduate Public Health student(s) who will assist with the project
- 4) Facilitate connections and partnerships, if possible, with campus and community entities such as the Florida Prevention Research Center and the World Health Organization Collaborating Center on Social Marketing and Social Change.

I, wholly support this proposal as it is much needed for this campus and I am excited to see the students take charge to make this happen. I fully support and am available to the students to carry forward this work. If you have any questions, please feel free to reach out by email: mpasha@health.usf.edu

Sincerely,

A handwritten signature in black ink, appearing to read "Mahmooda", written in a cursive style.

Mahmooda Khaliq Pasha, PhD, MHS, CPH
Assistant Professor
College of Public Health
University of South Florida

