*Please submit this completed application and any relevant supporting documentation by the deadline listed on the SSC website to* *Sustainability-Committee@Illinois.edu**.The Working Group Chairs will be in contact with you regarding any questions about the application. If you have any questions about the application process, please contact the SSC at* *Sustainability-Committee@Illinois.edu**.*

# General Information

**Project Name:** Large scale inplementation of E2E Paradigm for Food Waste to Biofuel and Biomaterial

**Total Amount Requested from SSC:** $100,000

**Project Topic Area(s):** [x] Energy [ ] Education [x] Food & Waste

 [ ] Land [ ] Water [ ] Transportation

# Contact Information

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**Project Team**

|  |  |  |
| --- | --- | --- |
| **Name** | **Department** | **Email** |
| Michael Stablein | Agricultural and Biological Engineering | stablei1@illinois.edu |
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# Project Information

Please provide a brief background of the project, the goals, and the desired outcomes:

Our research team proposes to expand the Environment-Enhancing Energy (E2E) research program to campus application, to augment management of wet biowaste, like food waste produced through the dining halls. More than 34 million tons of food waste was generated in the US in 2010 (EPA, 2010). According to Kelly Boeger, the Menu Management Dietician at the University of Illinois, 344,559 pounds of food goes unused by the cafeterias on campus which was worth $425,735 or 2.46 % of the overall budget as of 2015 (Hettinger, 2015). Moreover, this unnecessary spoilage creates additional cost and environmental burdens. On the other hand, this biomass presents an opportunity for UIUC to implement new resource recovery technologies to alleviate waste and increase student activities directly related to sustainability. Hydrothermal liquefaction (HTL) is a technology that utilizes elevated temperatures and pressure to convert wet biomasses to oil which can be used in motors or asphalts, potentiates greater sustainability by simultaneously remediating the food waste going to landfills and producing renewable energy.

Please provide a brief summary of how students will be involved in the project:

Our team is comprised of two PhD students and four undergraduate students under the supervision of Professor Yuanhui Zhang, a leading expert in the area of HTL of wet biowaste. The graduate students will lead the efforts during the project. This project involves some chemical laboratory tests organized by two graduate students, which will be a good opportunity for undergraduate student to learn and improve their experimental and analysis skills. After the project, an innovative food waste disposal approach will be reported and possibly published based on the information collected. We will also publish our results on campus media so that the other students can learn about the sustainability project. Aside from the three students listed, we expect there will be several undergraduate students will join the team for different tasks including food waste collection, conversion to biocrude, upgrading the biocrude, and campus presentations.

Please provide a brief summary of the project timeline:

The previous funded project beginning in the start of spring 2018 semester will have four phases, each phase consisting of 1 month approximately. The target date for submitting a final report will be in June of 2018. The first phase will consist of analyzing the feedstock sources from the dining hall for their energy content at laboratory scale in batch reactions and potential economical returns. In doing so, our team will determine which source has the greatest conceivable benefit to campus, based on quantifying the available waste and value recovery using HTL. The second phase of this project will consist of converting the oil phase of the laboratory HTL process into a refined product for the sustainability project. During this phase, the biooil will undergo chemical treatment to refine the petroleum alternative into a usable product that can substitute a campus cost. This portion of the work is essential to validating food waste HTL processing, as our projects will specifically improve UIUC sustainability. The following weeks will be focused on performing a larger scale assessment for expanding the HTL scope of feedstocks for further energy recovery using waste at larger scale, as well as determine the potential impacts on campus with sizable amounts of food waste.

Currently, we have reached out to several compus officials and related food waste sustainability efforts to perform an analysis of existing strategies for comparision, in addition to collecting data about food waste production in the dining halls. Among these, dining hall officials and waste management startups have provided key insights into how waste is being innovatively managed. We also have organized our team to perform necessary training with HTL equipment. These are important initial stages to prepare our team and gather relevant data that will be pivotal in food waste assessments.

Leading to phase 2 of the project, we will be scaling up the process to prove its feasibility in greater quantities using a continuous reactor (1 ton/day). It will take around one year for phase 2 project. Instead of proof of concept with a small amount of food waste, the system will handle a significantly greater amount of food waste and simultaneously generate enough HTL products for a larger campus sustainability deliverable. This phase 2 funding will be essential for the large reaction as some more costly equipment and helping hands (high pressure pumps and valves, pretreatment chemicals, manpower, etc.).

|  |  |  |  |
| --- | --- | --- | --- |
| **PHASE** | **OBJECTIVES** | **EXPECTED RESULTS** | **DURATION** |
| 1 | Food Collection, survey, lab scale experiments | Food waste composition and quantities | 3 month collection and organization + analysis  |
| 2 | Pilot scale conversion of food waste to biocrude and analysis | Determine oil potential of specific food waste products | 3 month |
| 3 | Preparation and design and sustainability demonstration | Use biocrude product to make fuel or asphalt for small demonstration | 3 month |
| 4 | Economic analysis for scaled up and continued use of HTL system | Potentiate larger impacts for campus with scaled up production | 3 month |
| Final | Final report preparation | Closing of the project | 3month |

Additional comments

This previously funded project (Dec 2017) is being reproposed for eligibility in the Phase 2 portion of SSC funding in April 2018. We are not requesting more funds for phase 1 at this time, as our current scope has not changed but been furthered with promise for larger reactions by summer time. We have elaborated on our progress and continue to advance our original motivations for conversion of food waste to renewable oil and asphalt binder by using Hydrothermal Liquefaction (HTL).