IQP group under Professor Timko
4/26/2021

Feasibility Study of Food Waste to Energy System: Hydrothermal Liquefaction

Project Statement:

Our IQP group was given tangible findings of an MQP report that suggested that an Hydrothermal Liquefaction Reactor could be implemented on campus and power WPI's vehicles and possibly power some of the buildings. This resulted in our IQP researching the social implications, and stakeholder consequences of implementing this reactor on campus at WPI. This reactor would use WPI's food waste and green waste to produce biocrude oil. This oil could be used in traditional heating systems and with a refinement process, can be used in cars and trucks with biogasoline and biodiesel, respectively. In addition to using this oil on campus this reactor could be converted to make biogas, which could run an electricity producing generator.

Methods:

Over the course of the past term, we have been collecting data on the yields of the reactor, the available waste, and the cost of implementation. This consisted of contacting different members of the WPI waste department and Chartwells food service. Once receiving the figures on the amount of green waste and food waste we began reaching out to different Hydrothermal Liquefaction Reactor producing companies to get a better idea of what would be implemented on campus. This included factors such as size, energy output, cost of operation, initial cost, essentially anything associated with the implementation of an HTL reactor on campus. Furthermore, once this data was accumulated, the team began it's outreach with a survey targeting active students, staff and faculty to gain a better understanding of the WPI public's support for this. Additionally, the school's provost of research was also contacted as this form of technology may be supported by government initiatives promoting green and renewable energy sources.

Interview Results:

After contacting both WPI facilities, and Chartwells food service, the team found the amount of green waste and food waste to be approximately 20 tons, and 750 tons, respectively. These figures allowed the team to contact multiple organizations to get an estimate on all aspects of this proposed reactor. It was found that this machine would need 1 to 2 people to run it. However, it is believed this could be run by properly trained existing faculty. Additionally, this machine would be priced in between 2.5 - 5 million dollars initially, with an annual cost of 100,000 - 175,000 dollars. However, this reactor would reduce WPI's carbon footprint by providing fuel for WPI buildings or facility vehicles. Additionally, If WPI chooses to produce biogas, WPI can produce a significant amount of electricity which could then be used on campus, or sell back to the power grid, even making this a profitable system. If WPI chooses to make biocrude oil, it could be sold to a refinery. In either case WPI could produce a profitable system that would help to reduce our carbon footprint. It was also found that this reactor could

serve as a multidisciplinary academic tool, teaching future engineers important skills, and enhancing our campuses research capabilities.

Survey/Provost Results:
We are currently still attempting to get into contact with the Provost of research to answer our questions generated from our initial interview results. Additionally, our survey is still active and we are still collecting results for our study.

Link to questionnaire:
https://wpi.qualtrics.com/jfe/form/SV_8qSTAQkkYXdT3SK