

SIU Sustainability Council Project
Final Report

Project title: A Study of the Design and Operation of Low Cost, Energy Efficient Bio-digester Heater

Project I.D. #: 101207

Award date: December 2012

Completion date: December 2013

Funds used (if different from award amount): \$5,165.74

Brief write up of project/project experience (not to exceed 250 words):

The aim of the project was to design, construct and test a bio-digester heater that was monitored remotely via wireless sensor network technology. The energy (heat) generated by the decomposition of organic materials contained within an apparatus, commonly referred to as a bio-digester, was monitored and recorded. The bio-digester was designed to capture that thermal energy and release it into an enclosed space such as a room (living area) as a means of climate control. An empirical study was conducted to determine the effectiveness of the bio-digester heater based on rate of heat generation. The results of our studies suggest that this approach could be adopted on a wide-scale basis for residential homes. Optimizing the heat energy output of a bio-digester heater system could lead to a revolution in sustainable heating that would reduce the carbon footprint of our society, and extend the lifespan of the world's fossil fuel reserves. The systems can also provide an alternate means of disposal for organic waste, which will extend the lifespan of landfills.

Best things learned/produced from project:

One of the best things learned from the project is the resourcefulness of undergraduate students. Also, the excitement generated by the project. Initially, only two undergraduate (seniors) students were committed to the project but by the time we actually got the grant and started work we got two more undergraduate students (juniors) actively committed to the project. This was indeed welcomed since it meant that there could be an easier transition to additional phases of the project even after the senior undergraduate researchers graduated. We also experienced a great level of support and cooperation from the various units on campus including on-campus housing, which was contacted for waste to be used to fuel our bio-digester. In regards to the students, based on their own feedback, they have learned to properly conduct applied research and have gained a better understanding of how to conduct literature review.

How do you define sustainability?

The Webster dictionary defines sustainability as "able to be used without being completely used up or destroyed" and "involving methods that do not completely use up or destroy natural resources". The definition essentially captures our own idea of what sustainability means. In the

context of our project we sought to develop an alternate approach that would make use of waste in a way that is less harmful to the environment.

Has this changed over the course of your project? If so, how?

Our definition or understanding has not significantly changed. However, the degree to which we believe sustainability is important to the long-term health of our planet has increased significantly, moving from just an academic awareness and appreciation to the extent that we now see it as both essential and urgent.

What do you see as the next step for the project?

We have constructed and conducted initial testing of a bio-digester heater and studied the heat (energy) produced using wireless sensor technology. The bio-digester is based on anaerobic digestion, that is, a series of processes in which micro-organisms (bacteria) break down organic material in the absence of oxygen. For the next phase of the project we intend to conduct advance empirical testing and analytical modeling based on thermodynamics principles in order to obtain an optimized prototype.

Optional: Do you have any suggestions for the SIU Sustainability Council to improve the Green Fund award process?

From my vantage point I believe the Sustainability Council is doing an excellent job in funding noteworthy projects across a diverse groups of applicants. My only concern though is with the disbursement of funds. As you may know, some departments, including my own, do not have substantial discretionary spending or flexible budgets, therefore not getting the full award at the beginning may cause cash flow issues, especially in regards to paying student workers/ graduate assistants. I am mindful of the need for checks and balances to ensure that there is proper accountability and am not sure if anything can be done to make this better. Nonetheless, I humbly suggest that once the graduate assistant/student contract has been signed then all the salary funds be transferred to the department. In such a case, the chair of the department and not the grant awardee is the fiscal officer of the funds. Therefore, it is incumbent upon the chair of the department to ensure that the students' stipends (salary) are not affected due to lack of department funds. Thus, avoiding a situation where students are not paid because the 50% portion of the award has been exhausted. In terms of other expenditures (that is, beside student compensation), I think the current approach is probably the best method to ensure that the funds are used as intended.

Attach a minimum of five images – these will be used to promote interest in Sustainability Council projects. These can be photographs of the progress of the project, the completed project, or promotional materials.

I have attached a draft journal paper that includes the required images.

