# *Thank you for your commitment to green initiatives at the University of Illinois. One of the ongoing requirements listed in the terms of the funding agreement for your project is the submission of semesterly reports with key information about your project. In addition to this form, please provide additional financial documentation and/or progress photos if available.*

# *Please be as accurate as possible in describing the project (including possible setbacks or challenges in meeting the initial goals of the project). Not fully meeting your project's goals will not disqualify you from making future funding requests as long as your reports are as complete and accurate as possible. If you have any questions, please contact the Student Sustainability Committee, at* *sustainability-committee@illinois.edu**.*

**Project Name:** Illinois Biodiesel Initiative

**Date of Report Submission:** 1/20/2018

**Project Purpose:**

The primary goal of the Illinois Biodiesel Initiative is to establish a closed loop system to process waste vegetable oil from university dining halls such as the Ikenberry Dinning Hall. The two main products IBI creates are the biodiesel and soap made through the recovery of glycerin from glycerol. The secondary goal of IBI is to educate students about renewable fuels sources and expose them to activities not given in required lab courses.

The Illinois Biodiesel Initiative is student led with the production of biodiesel processed by student volunteers. The students’ activities are overseen by a faculty advisor (Ben McCall), and the initiative is under the administrative umbrella of iSEE.

**Detailed Accounting of Expenditures to Date:**

The detailed expense report is attached to the email. The two substantial expenses were hiring two hourly undergraduate workers (in order to accelerate our progress towards our initial goal of producing biodiesel that meets ASTM specifications) and a variable RPM continuous centrifuge (in order to remove particulates and undesirable oils from our feedstock).

**Project Progress to Date:**

The original project proposal was set for a much larger space than what we are currently allotted for in Noyes 250 where we currently have our operation set up. It is our goal to consistently produce high quality biofuel and petition for space in the IBRL when it is available to host us. We still have all of our equipment designed for much larger batch processing power than we are currently operating. At this moment, floor space is limiting the amount of fuel we can produce and store in the lab at one time.

Two hourly student workers were tasked to troubleshoot the quality control issues that were occurring during biodiesel production and to maintain day to day operation of lab activities. The quality control test that consistently caused issues was the kinematic viscosity test, also known as a cold soak test. This interrogates the fuel’s ability to flow through an engine’s fuel filter. A set amount of fuel needs to pass through a 0.7 micron filter under 360 seconds.

We have run three 50-gallon batches through our BioPro 190 reactor since establishing operation in Noyes 250. The first batch was heated and filtered through a 100 micron bag filter. This was ultimately unsuccessful and the 100 micron filter frequently clogged. The first batch was shown to be problematic in multiple quality tests. This result was attributed to letting the waster vegetable oil sit for a significant amount of time before reacting it. The second batch used waste vegetable oil taken from the dining hall and reacted the same day with minimal filtration. This batch failed only two quality tests: presence of particulates, and kinematic viscosity. For the third batch, a newly bought continuous centrifuge was used to take off the saturated fats and other dense particulates from the waste vegetable oil. The oil was then passed through a 150 micron filter which is twice as fine as the minimum requirement. The results of the third batch will be sent to an analytical lab to confirm our in-lab testing.

If the test is successful, we can move forward with constructing platforms for the lab equipment to create a closed loop and improve the level of safety of operation. We are also working on the proper disposal of the batch reactions which did not provide quality assured results as well as methanol water mixture coming from the wash cycle. The main goal in this scenario is to upscale production and create a flow of quality assured biofuel out of our lab. Aside from production, we will begin acquiring our own quality control equipment as proposed, in order to reduce the need for ongoing quality control tests by outside laboratories. This will also provide us with a timely way to assure each batch we produce meets the standards expected by our fuel customer (Garage & Car Pool).

If the test is unsuccessful, we will begin the troubleshooting and testing concepts until the kinetic viscosity issue is solved. This has been our major roadblock at the moment and has prevented us from developing beyond our current rate of operation. The plan moving forward would be to inquire about the specifics from ASTM to ensure the preparation of the sample is carried out properly. Additionally, it must be considered that the feedstock purification process is not rigorous enough and further separation between the saturated and unsaturated fatty oils may be necessary.

Once the biodiesel production process has been fine-tuned and verified with in-house quality control tests, we plan to refine our biosoap production process, which will provide a significant revenue stream (from sale to Dining Services) to support the ongoing operation of the biodiesel production beyond the period of SSC support.

As is typical for student-led efforts, the Illinois Biodiesel Initiative has experienced a significant amount of flux in membership. An ongoing challenge is the fact that most of the responsibility rests with a small group to lead every facet of our project goals. We are currently taking the steps to bring in a larger pool of dedicated student leaders to distribute the work load and ensure continuity of operations as students graduate.

**Student Involvement and Outreach to Date:**

The Illinois Biodiesel Initiative is, and will continue to be, student led. In addition to the initiative itself (overseen by a faculty advisor and under the iSEE administrative umbrella), there is also an affiliated registered student organization that engages in related educational, outreach, and recruiting activities.

The executive board of the IBI RSO is comprised entirely of dedicated undergraduates. We “promote from within,” in other words we invite students who show genuine interest in the program to apply for officer positions (e.g., president, vice-president, sub-group leaders, outreach chair, Engineering Council representative).

We have established an ‘understudy’ program to find freshmen or sophomores to work under the Quality Control Manager or the Production and Testing Manager. Since these are the two biggest roles with the largest responsibilities, we are actively training new members to take on larger roles. The Illinois Biodiesel Initiative provides an active, hands-on learning experience for students with techniques they normally would not encounter in conventional university laboratory courses.

**Marketing and Promotion Efforts to Date:**

Our primary efforts in promoting the IBI have been on Quad Day and other large undergraduate events, such as engineering open house. We have also tried to publicize the IBI and the associated course through iSEE and via Facebook. Our main marketing efforts are directed towards recruiting new members.

**Additional Comments:**

We are constantly improving our documentation efforts. Since leadership rests on undergraduate students, leadership transition documents will be made. Standard operating procedures have been made for the BioPro 190 and the Methanol Recovery Unit-50. These are edited or added to if necessary. Students are restricted to one side of the laboratory, away from the heavy equipment, unless they are certified by the Department of Research Safety to working in research labs on campus.