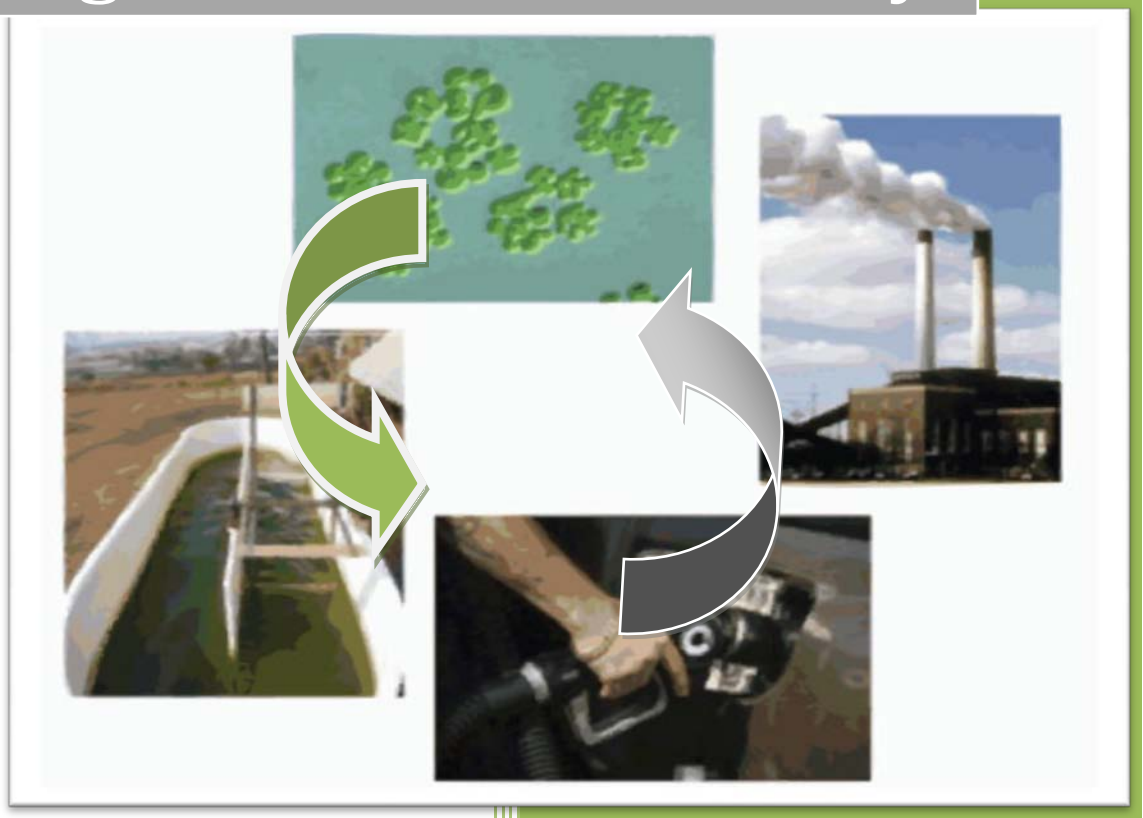
2009

UIUC Algae Biodiesel Facility



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INTRODUCTION

The Algae Biodiesel Production Facility was commissioned to demonstrate green house gas mitigation and bioenergy production technology through the mass cultivation of algae. In addition, we hope to promote public education and engagement in sustainable energy practices. Throughout the course of the semester we have focused on the following five areas for the project:

1. Cultivate and select algae strains that will be used at the facility
2. Construct bioreactors that will be used to inoculate the outdoor pond system
3. Investigate the most suitable method for oil extraction and conversion
4. Team with Abbott Power Plant to design and install the gas delivery and open pond system
5. Increase visibility of the project through media exposure

PROJECT STATUS UPDATE

Lab Cultivation of Algae

Professor Schideman's research group has been selecting and testing various algal strains in the laboratory to determine the ideal species for use at the facility. Several growth parameters have been examined including nutrient uptake, oil/lipid content, and temperature and light exposure sensitivity. His group has selected two potential fresh species, *Chlorella* and *Nannochloropsis,* for use at the facility. Both species have been used in previous applications for flue gas mitigation and oil production.

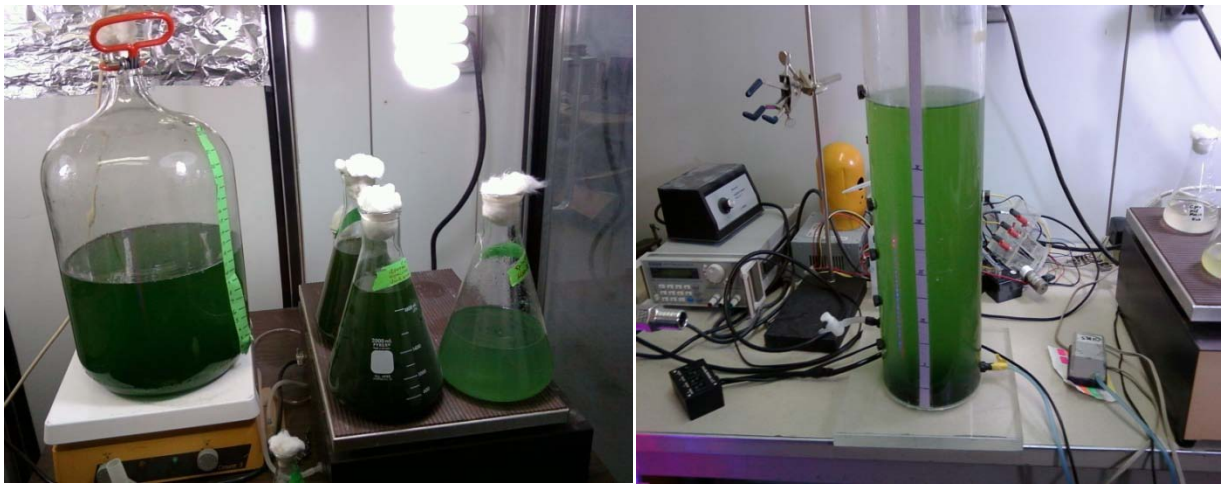

Figure 1. A variety of algal cultures have been grown and examined in the laboratory for use at the facility.

Algae Bioreactors

Our group has recently ordered a series of bioreactors that will be used to inoculate the open ponds and initiate growth on a mass scale. The reactor system will be located adjacent to Abbott Power Plant on the south side of the building. Periodically, the open pond system will need to be drained and restarted to eliminate invasive species that can limit oil production. The outdoor reactors provide a controlled environment to prevent foreign contamination and grow necessary spike volume.

The reactor system was designed and ordered with the aid of aquaculture engineers at Aquatic Ecosystems. The company specializes in fish and algae mass cultivation. Their growth chambers have been used successfully at multiple locations including the University of Hawaii as shown below. Construction of the bioreactor system is scheduled to begin at the end of the month.

Figure 2. Example of outdoor bioreactors used at the University of Hawaii.

Oil Extraction and Processing

Our group has contacted Doug Bennett, the research coordinator at the Illinois Sustainable Technology Center (ISTC), in order to target the best method for algae oil extraction and biodiesel conversion. Several chemical methods have been examined including hexane and methanol extraction. Additionally, Professor Schideman's research group was contacted by a local biodiesel production company, BioAlternative, for testing their patented mass oil extraction and conversion process. This process offers a promising solution to reduce the cost and improve the oil yield recovery for algae biodiesel production.

Flue Gas Delivery and Open Pond System

Our group has met with Mike Larson, the director of facilities at Abbott power plant, to obtain the necessary safety and environmental permits to begin construction of the Algae Biodiesel Facility. Due to the safety hazards with working on the roof of Abbott Power Plant, Mike Larson has agreed to relocate construction of the facility adjacent to the south side parking lot and access road. This new location is beneficial since it increases accessibility to the public and provides the necessary footprint area for the project.

In addition, efforts are underway for the design of the gas delivery and open pond system. Our group is working with a technical advisor at Abbott Power Plant to draft a detailed schematic and material budget for the system. We have also contacted Michael McCloud at XL Renewables to provide consulting for the outdoor pond system. His company offers the necessary materials and technical expertise for outdoor pond culturing on a mass-scale. They sell commercial systems on a 40-acre basis, but have agreed to provide a scaled-down version for demonstration and research use at our facility. Their technology provides a promising solution to reducing the production cost of algal cultivation and generating a cost-competitive alternative to fossil fuels. A tour of their pilot plant is scheduled for July of this summer.

Figure 3. Outdoor ponds used at XL Renewables pilot plant in Vicksburg, Arizona. The troughs are constructed using traditional agricultural equipment and the bed liner provides aeration for growth.

Media Exposure

Our project has recently received exposure from both the public relations office with the Department of Agricultural and Biological Engineering and the Office of Sustainability. Both groups have conducted a professional photo shoot for their campaign and have highlighted our work using algae for bioenergy. These photos will be displayed on their website and will promote the efforts of the Algae Biodiesel Projects. Similarly, construction has begun on our project's website that will be open to the public.

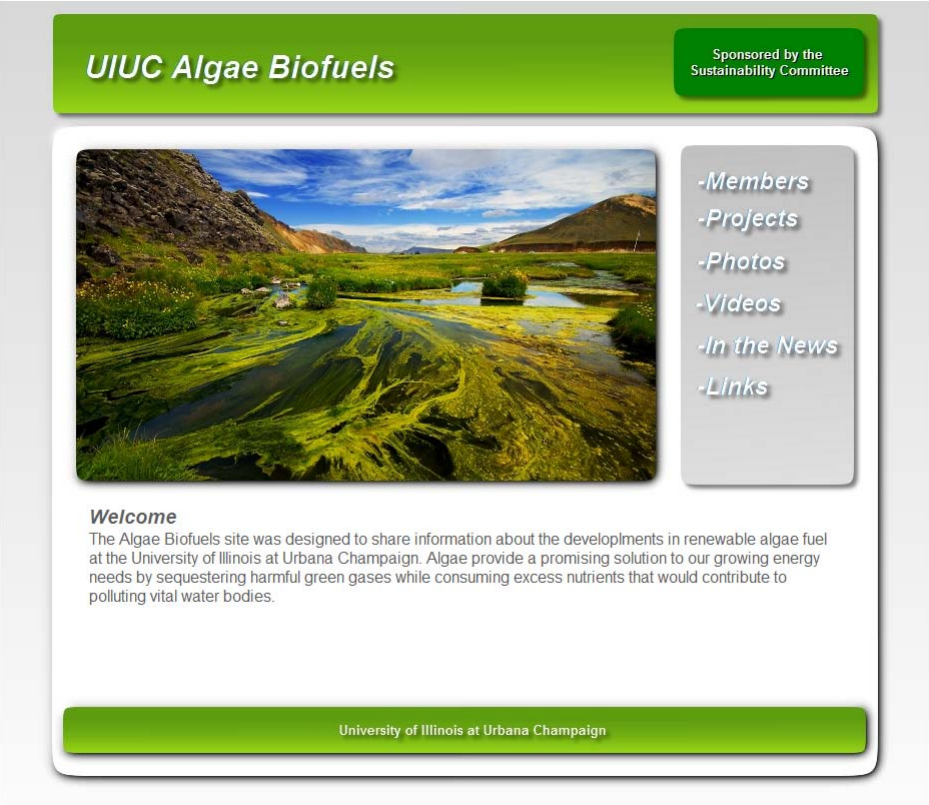

Figure 4. Screenshot of our project's website which is currently under construction. The website will host information, photos, and videos to educate the public and encourage sustainable energy practices.

CONCLUSION

Our group has continued to develop and advance the Algae Biodiesel Project here at the university. By strengthening our relationship with members of Professor Schideman's research group and the staff at Abbott Power Plant we have been able to partner together and achieve greater progress. We plan to complete our project within the proposed time frame and hope to coordinate innovative research with community outreach efforts. Through this project, we will strive to make a significant impact on campus and improve awareness in environmental sustainability.

PROJECT TIMELINE

The following table describes the anticipated timeline for the Algae Biodiesel Project. This timeline proceeds in accordance with the initially proposed schedule.

Scheduled Task	April		May				June				July				August			
	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4
Bioreactor - *Assembly*																		
Bioreactor - *Install*																		
Flue Gas - *Design*																		
Flue Gas - *Install*																		
Open Pond - *Design*																		
Open Pond - *Install*																		
Algae -*Harvest*																		
Algae -*Extract/Covert*																		
Outreach - *Website*																		
Outreach - *Tours*																		

PROJECT BUDGET

The following table describes the fund spent and remaining for the Algae Biodiesel Project. Current expenditures are in accordance with the initially proposed budget.

Items	Cost	Items	Cost	Items	Cost	Items	Cost	Items	Cost
REACTORS		**CULTURE**		**CO2 DELIVERY**		**HARVESTING**		**LABOR**	
cap	$144	conditioner	$40	ph probes	$236	pump	$55	wages	$3,600
tank	$1,045	cultures	$90	solenoid	$320	siphon	$52	supplies	$800
brush	$9	shipping	$107	buffer solution	$28	filter vessel	$292		
shipping	$269	media	$178	diffuser	$105	gauge	$24		
		media	$178	tubing	$28	adapter	$8		
				manifold	$34	filter bag	$60		
Subtotal	$1,467	***Subtotal***	$593	***Subtotal***	$751	***Subtotal***	$492	***Subtotal***	$4,400
Remaining	$2,533	***Remaining***	$7	***Remaining***	$2,249	***Remaining***	$508	***Remaining***	$4,400
						TOTAL FUNDS SPENT			**$3,302**
						TOTAL FUNDS REMAINING			**$9,698**