Canola, and Methane, and Bio-mass, OH MY:
The Adventure to find Alternative fuels

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Abstract:
Luther College has committed to reducing their carbon footprint and amongst the myriad of options, exists Biofuels. Luther College has already invested in some Biofuels, but much more potential exists. We conducted field studies and contacted suppliers to explore the feasibility of extending Luther College’s Biofuels portfolio into anaerobic digesters. We were un-able to get a quote due to the lack of response from our company of choice, but they did provide a preliminary estimate that makes the project unreasonable. The project is economically unreasonable, but it may be a good decision anyway to increase Luther College’s sustainable energies portfolio.

Bio-fuels

Benefits to be earned:
- Reduce dependency on fossil fuels
- Reduce waste sent to landfill
- Reduce greenhouse gas emission
- Getting full potential out of specific waste types
- Achieve carbon neutral status
- Give local businesses a waste disposal option

What are bio-fuels?
Bio-fuels are an energy source derived from waste organic matter and subsequent combustion. These forms of energy are carbon neutral and renewable. Some examples of common bio-fuels are wood, vegetable oils/bio-diesel, ethanol, and man-made methane gas. These types of energy are used throughout the world in different settings. After a trip to the Baron, Wisconsin area we found that methane held an interesting potential for alleviating our fossil fuel dependency. Methane is a common ingredient in natural gas, which is not a renewable energy source in natural settings. However, it can be produced by harnessing the biological potential of living organisms such as bacterial anaerobes. When breaking down organic matter in an oxygen deprived setting, methane gas is a bi-product of the organisms. This methane gas can then be captured, bottled, and burned to power electricity generators or even internal combustion engines.

The Barron, WI field trip:
Our group of two had the special opportunity to visit some thriving bio-fuels advocates. The first stop brought us to the Barron Public School system. The school was utilizing bio-fuels to heat and cool their school. They retrofitted their boiler system to burn bio-mass, wood chips. The wood chips came from a nearby telephone pole mill, and a local farmer with a wood chipper. The system automatically fed wood into the incinerator, and slowly set it ablaze maximizing the efficiency of the furnace. For further information about the feasibility of a bio-mass furnace see the article written by Sebesta Blomberg in the Sustainability Offices.
The second of our stops was at a small dairy operation outside of Barron called Indianhead Farms, INC. The owner Bob Schauf, converts canola seeds into a bio-diesel fuel through a special press that extrudes the oil from the seed pod. A bi-product of canola pressing is a highly nutritious meal that can be used as feed for various animals. The process of making this bio-diesel was very simple, much simpler than what is currently being done on campus. His equipment using the bio-fuels needed to be retro-fitted to handle the vegetable oil. We liked this idea of a vegetable press because the byproduct could be sold back to the community decreasing the pay-off time of the press.

The third and final stop was at Norswiss Farms, INC. This was a huge dairy operation that derived a large amount of their energy from an anaerobic digester. An anaerobic digester is a large machine that uses manure, food waste, or straw bedding to produce methane gas. The methane is then combusted, releasing energy. This was a feasible option for Norswiss Farms because of their huge supply of manure from the cattle, and the systems high efficiency.

After seeing these three types of bio-fuels in action, we felt a little more comfortable in forming opinions and making recommendations that could help decide the fate of Luther College’s bio-fuels future.

Luther College Opportunity:

After visiting Baron, WI we reconvened at Luther College and talked with head of Facilities, Rich Tenneson, who accompanied us on the trip. Mr. Tenneson was very interested in all of the technologies displayed during our field trip, but agreed with us that anaerobic digestion would be the best place to invest our time. We then theorized the following plan: Anaerobic digesters require a continuous stream of organic matter and that could be provided by Luther College’s Cafeteria's compost program. This provides a modest stream of 230 gallons per week. This could be augmented by grass clippings and marketing space in the digester to Decorah businesses. Businesses could buy space in the digester for their organic waste. This would be marketed to restaurants and the fee may be waved, depending on how charitable Luther College would like to be. The digester could then be available to produce methane for the College’s methane powered fleet with the hope of expanding this fleet due to the increase in methane availability. We also found examples of micro anaerobic digesters being used in India to provide methane for residents daily cooking. This would be a great pilot project for further studies and could be piloted in LEFSA.

Anaerobic Digestion:

We mentioned anaerobic digestion early, but without much explanation. Anaerobic digestion requires organic matter to be broken down in an oxygen depleted environment. The organisms that break down this organic matter create methane and other gases. Anaerobic digestion and aerobic digestion, or composting, are similar but require different bacteria and create different byproducts. “Aerobic fermentation [composting] produces carbon dioxide, ammonia, small amounts of other gases, considerable heat and a residue which can be used as fertilizer. Anaerobic decomposition—on the other hand—creates combustible methane, carbon dioxide, hydrogen, traces of other gases, only a little heat and slurry which is superior in nitrogen content to the residue yielded by aerobic fermentation.”(Gobar Gas Source 1) Anaerobic decomposition has been happening for ages, we can thank it for our fossil fuel reserves. But, a little more recently homes in India have harnessed the energy potential of the manure their many cows produce. In India they use systems that produce gobar gas. Gobar is the Hindi word for cow. Many homes in India have micro-anaerobic digesters that process cow manure and create methane that is burned in their homes for cooking. Their systems are very similar to the large scale systems installed in the U.S.A and around the world. The organic waste is placed in the digester, which is air tight, and a two step process commences. First, micro-organisms break down the organic matter producing acids, simpler sugars, alcohol, glycerol, and peptides. Then another group of organisms break those down
into methane and the other gases (Gobar Gas Source 1). The methane floats to the top, because it is lighter than the other gases and it can be siphoned off. The remaining byproduct is released out of the tank and can be used as fertilizer. When thinking what a digester needs, it is helpful to think what 'your' digester, colon, needs. A stable supply of food, constant temperature (around 100 degrees Fahrenheit), and not too much of one thing at a time are all necessary to keep an anaerobic digester healthy.

**Who we contacted:**

We began our conversation with the director of Facilities at Luther College, Rich Tenneson. We traveled with him to Baron, WI and bounced ideas off of him while visiting with him in his office. He gave us his insights on what he would like to see for Luther, and also offered up some support for a small methane digester, especially for a small pilot of a micro digester called Gobar Gas. We then continued to investigate the large scale digesters. We found multiple companies that install anaerobic digesters, but decided on only contacting an Iowa company, Cady, Inc. Contacting Cady, Inc. proved to be rather difficult. On first contact we found that we needed to talk to the manager and that he was out of the office. The secretary gave us his cell phone number and we commenced calling him. We called him continually, but never elicited a response. We contacted the company again and after a little investigation found another employee that would be able to answer a few questions. After talking to this man for around 30 minutes we asked him to give send us a quote. We are still waiting for a reply. But, during our conversation he said we would be looking at a 50 year pay off period and to shorten that period considerably we would need a minimum of 315,000 gallon total capacity. Total capacity is the amount in the tank at one time, and is equal to about five weeks of waste (we currently have only 1,100 gallons available to add). We were happy with this company’s helpfulness on the phone, but they have dropped the ball when getting the information to us. We would suggest pursing this company a little more, but quickly look for an alternative partner.

**Outcome:**

In the end it may not be financially feasible for Luther to incorporate any large scale bio-fuel operation. Luther simply does not create enough organic waste to make the purchase of an anaerobic digester, and the money that would go towards such an acquisition is far more than Luther has in the budget for sustainability. But, with proper marketing it may be possible to find enough additional organic waste to justify a larger digester, thus reducing its pay off period. In the meantime, it would very interesting to install a Gobar Gas producer at LEFSA. This could increase the College’s awareness of the incredibly diverse alternative energy opportunities in the world today.

**Sources:**

Cady Aqua Stores Inc. 920 W Prairie Drive Suite G Sycamore, IL