Sustainable Management of the Organic Waste at the Spy Hill Campus of the University of Calgary

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Comparison Among Three Alternatives

Aspect	Anaerobic Digester	Transfer to University (Main Campus)	Transfer to WA Ranch
Environmental	✓ Less emission. ✓ Carbon offset possible. ✓ Practice circular economy ✓ Integrated solid waste management can be established. ✓ Prevent soil and water from being contaminated.	✓ Moderate emission. ✓ Practice circular economy if compost can be used on own land. ✓ Minimize the use of chemical fertilizer. × A carbon offset is not possible.	✓ Highest emission among all three options. ✓ Minimize the use of chemical fertilizer ✓ Open up the probation of biogas generation, which paves the way to carbon offset. ✓ Practice Circular economy.
Energy	✓ Approx.112MW/Year of electricity can be produced. ✓ Production of RNG ✓ Gas can be used to heat the boiler.	× N/A	× N/A
Financial	✓ Utility Cost Saving × High initial investment is required due to machine, operator & and labour costs. Typically, the capital cost is approximately $3,700-$7,000/KWh & running cost is about 0.02/KWh (Navaratnasamy et al., 2008). For instance, in Ontario, an on-farm bio-digester system for power generation costs around $2 to $3 million (Berg, 2019) × An additional workforce is required to operate the process.	× Only labour transport cost ✓ Selling fertilizer can make money. Theoretically, $343.20/ton can be earned by selling compost ✓ Save fertilizer cost	✓ Only labour cost ✓ Minimize Fertilizer Costs of the farm.
Social	✓ Increase Employment Opportunities. ✓ Could be an idol towards zero emission campus.	✓ Practicing Sustainability. ✓ Example of a sustainable community.	✓ Promote Organic Farming ✓ Increase Employment Opportunities.

PROJECT LINKED WITH SDG

SDG 8: DECENT WORK AND ECONOMIC GROWTH

SDG 11: SUSTAINABLE CITIES AND COMMUNITIES

SDG 12: RESPONSIBLE CONSUMPTION AND PRODUCTION

PROJECT BACKGROUND & FINDING

Background

- 80 Large Animals
- Does not Allow the Sale or Spreading of Materials
- High Nutrient Value
- Donating to the Local Farmers

Project Findings

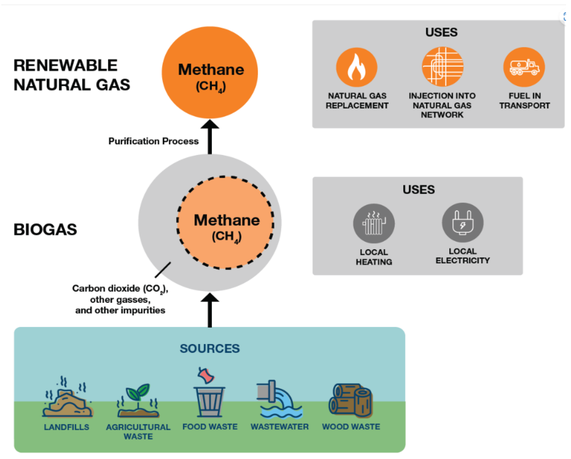
- Line of Alternatives Considering Energy, Environment & Financial prospect

Kitchen waste

Hazardous Bio-waste

Non-Hazardous Bio-waste

Bagged Straw



Power Generation from the Anaerobic Digester

From 1Kg of Waste,

Methane Generation (m3/day) =	0.50(m3/day)
Methane Generation (m3/year) =	183.0671834m3/year

Assume,

Gas extraction efficiency =	90%	
Heat Value of Methanw	34MJ/m3	
Power gwneration Capacity	1MW = 1 MJ/sec	
Efficiency of Power Convertion	80%	
Methane generation per second	0.0000058050	m3/sec
The amount of extracted gas	0.0000052245	m3/sec
The heat value of methane	0.000177634	MJ/sec
	0.000177634	MW
The Capacity of Power Plant	0.00014	MW/Year
	0.14	KW/Year
	3.41	KWh/Yr

we know, if 1pc 10 W LED bulb run for 1hour per day then it will consume 3.65 KWh/yr

Similarly, if 1pc 5 W LED bulb run for 1hour per day then it will consume 1.82 KWh/yr

So, we can use almost 2 bulbs of 5W 1hr daily for a year.

At present, they are piling the materials for aerobic composting. Finally, composting materials are donated among the farmers.

Requirement of Alternatives

- Making the process more Sustainable in terms of less emission, environmentally friendly & financially viable.
- Utilize High-quality Products.
- Around $200 cost to manage bagged materials

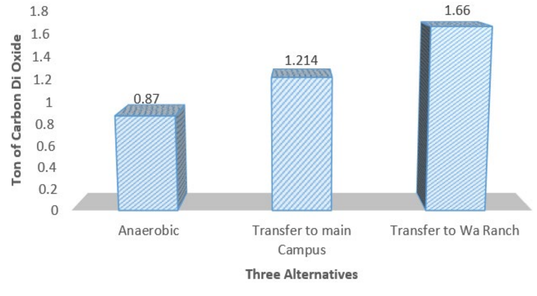
Pros

- Easy to process
- No Additional Manpower Required

Cons

- Creating Odor
- Storage problems may occur if composts are not removed.

EMISSION DIFFERENCES



Though Anaerobic digestion is costlier comparing to other alternatives, with the long run it will be the best alternatives.

Moving to WA ranch is the second-best option. Though it will increase CO2 emission but financially it is beneficiary.

However, if the university can use ranch's truck and university's ground staff then it would be good option.