Comparison Among Three Alternatives

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Anaerobic Digester</th>
<th>Transfer to University (Main Campus)</th>
<th>Transfer to WA Ranch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td>✓ 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.</td>
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<tr>
<td>Energy</td>
<td>✓ Approx. 11.2MWh/year of electricity can be produced. ✓ Production of RNG ✓ Gas can be used to heat the boiler. ✓ 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.</td>
<td>✓ N/A</td>
<td>✓ N/A</td>
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<tr>
<td>Financial</td>
<td>✓ Utility Cost Saving ✓ High initial investment is required due to machine, operator &amp; labour costs. Typically, the capital cost is approximately $3,700-$7,000/KWh &amp; 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</td>
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PROJECT LINKED WITH SDG

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

EMISSION DIFFERENCES

Power Generation from the Anaerobic Digester

From 1Kg of Waste:
- Methane Generation (m³/day) = 0.50 (m³/day)
- Methane Generation (m³/year) = 183.0671834 m³/year

Assume,
- Gas extraction efficiency = 90%
- Heat Value of Methane = 34 MJ/m³
- Power generation Capacity = 1 MW = 1 MJ/sec
- Efficiency of Power Conversion = 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

The Capacity of Power Plant:
- 0.14 MW/year

We know, if 1pc 10 W LED bulb run for 2hour per day then it will consume 3.65 KWh/yr
Similarly, if 1pc 5 W LED bulb run for 2hour per day then it will consume 1.82 KWh/yr
So, we can use almost 2 bulbs of 5W 1hr daily for a year.

EMISSION DIFFERENCES

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.