

Manure to Methane: *No Waste Will Go To Waste*

Nick Deraney (Chemical Engineering), Victor Agudelo (Mechanical Engineering),
 Ronald Mazurkiewicz (Aeronautical Engineering), Michael Enko (Environmental Engineering)
 Advisor: Professor Svetlana Nikitina (Humanities & Arts)
 Sponsor: Mr. Martin Burt, founder of Fundacion Paraguaya



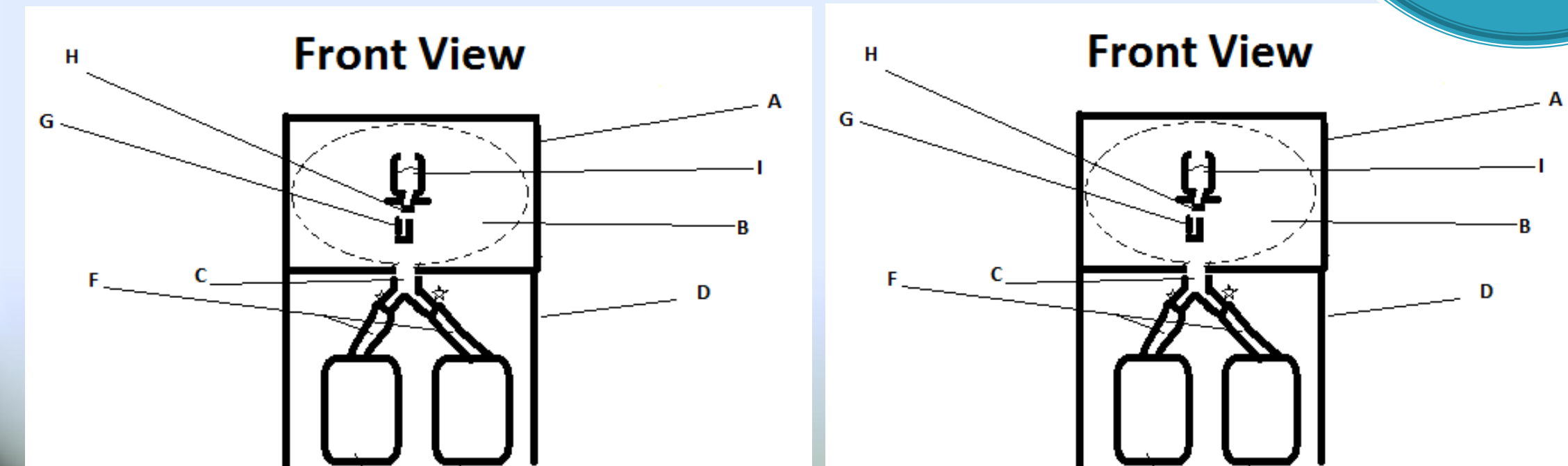
Abstract

As hot water is an expensive amenity for The Fundacion Paraguaya, Team Manure to Methane has designed a continuous batch biogas generator as well as created instructions for local operators on how to use it. We compared many different biodigester systems to select the most efficient and economical design for The Fundacion Paraguaya. During the research and development phase, we addressed such cultural constraints as language barrier and budget, as well as ensured such a design met with expert approval from professionals in the chemical engineering field for its functionality. As a result of our research, we were able to successfully design a biodigester and provide a materials list as well as instructions on how to use and maintain it. The design consists of a series of storage tanks that serve as containers for the manure as it decomposes. The methane generated this way rises up during the decomposing process and is captured in a common holding container (a plastic bag). The chosen digester design is in the format of a continuous batch system. We chose this method because it allows the manure to sit for 30 days, the minimum time it takes to sanitize the slurry, as well as provides a continuous production of methane. Our design lives up to the principle of "no waste will go to waste" of *Cradle to Cradle* textbook. Our design maximizes the nutrient value in the once harmful and dangerous sludge as it produces a potent and healthy fertilizer as a byproduct. To guarantee that our system could be understood and implemented at the School, the designs will be provided in Spanish as well as English. After many weeks of research, we are confident that our design will help reduce the School's dependence on electricity.

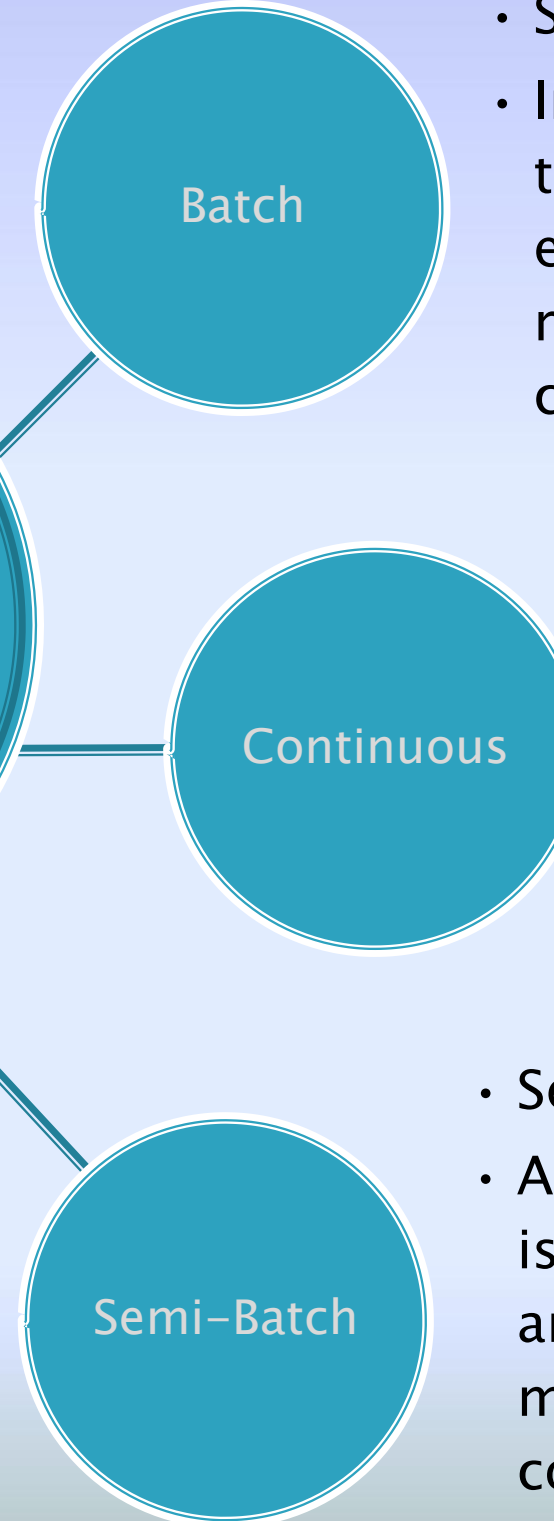


Methods/Process

A number of design possibilities were explored before determining the optimal design. The systems we had to decide between were a plug-flow system which is a continuous type of biodigester, an angled hole design which is another continuous biodigester. Upon consulting and interviewing Professor Robert Thompson of the Chemical Engineering Department, we found out that for the operation to be sanitary we needed to work in batches (a system where each time waste is entered it must be allowed to sit for a certain time period) in order to be most effective we must have a system going at all times to ensure power is always being produced. This type of system is a semi-batch system.



Type of Biodigester



- Separate Containers
- Individual systems that go through an entire period and are replaced upon completion
- Single Container
- One system where the flow is always being put through however the process is never completed, as maximum energy is not fully harvested
- Separate Containers
- A container, or batch is always working and decomposing manure, as a container ends its cycle, another begins



Background

The Fundacion Paraguaya is an NGO that works to "Promote rural development by providing a first class agricultural, technical and business education to students drawn from low-income rural backgrounds. To generate sufficient income from school activities to build a financially viable, and subsidy-free program"

The Fundacion Paraguaya is in need of an alternative method of heating their water on the campus of their Organic School



Objectives/Goals

- Supply schematic designs for a cost-effective biodigester
- Create a guide for the use and maintenance of an efficient biodigester in English and Spanish
- Supply materials list in both English and Spanish

Conclusions

- Our system currently can only produce half of the energy needed to heat the water, however, with a larger budget can be scaled up
- A mixture with a ratio of 1:1 parts, based on weight, of manure to water must be maintained

Recommendations

- Have a maintenance crew inspect the system for damage and ensure it is functioning properly once a week
- Look into grants that could be used to increase the size of the system and thus further lower the cost of energy



References

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