

# Renewable energy from organic waste: A biogas digester



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KFUPM Design Expo

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## Elevator Pitch

This innovative biogas system converts animal, human, and food waste into sustainable natural gas using solar energy. Our technology reduces agricultural and chemical industrial running expenses and improves waste management by providing economical on-site fuel. Our system assists farming and chemical engineering industry economically and environmentally.

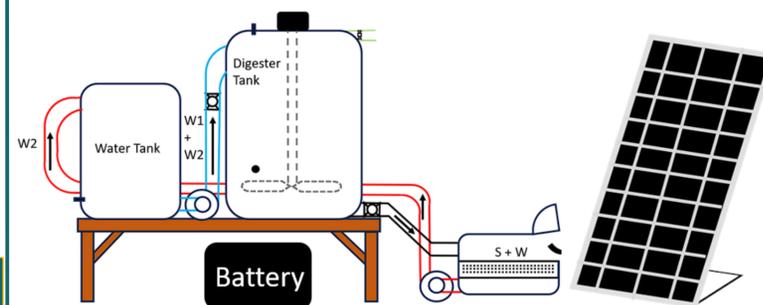
## Objective

- Design a compact, eco-friendly biogas digester for waste management and renewable energy.
- converting waste streams into biogas and nutrient-rich digestate.
- Promote sustainable energy with scalable, low-impact solutions.

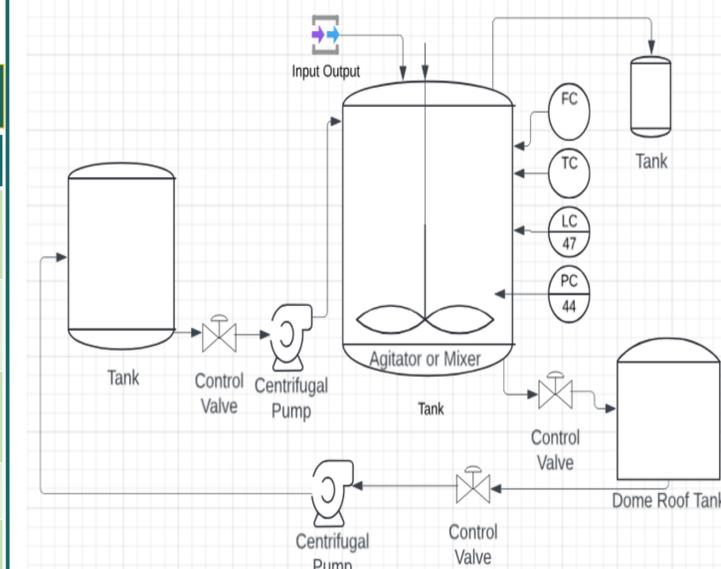
## Constraints & Specifications

Specification	Value	Constraints/Specifications: Met with evidence
Capacity	0.002-0.003 m <sup>3</sup> /day	Yes
Biogas Production	0.004-0.0065 m <sup>3</sup> /day	Couldn't be tested
Safety Measures	Shutdown in 5-10 seconds	Yes, see sensors
Space Requirements	2-3 m <sup>2</sup>	Yes, see prototype
Operational Efficiency	70-80%	Couldn't be tested

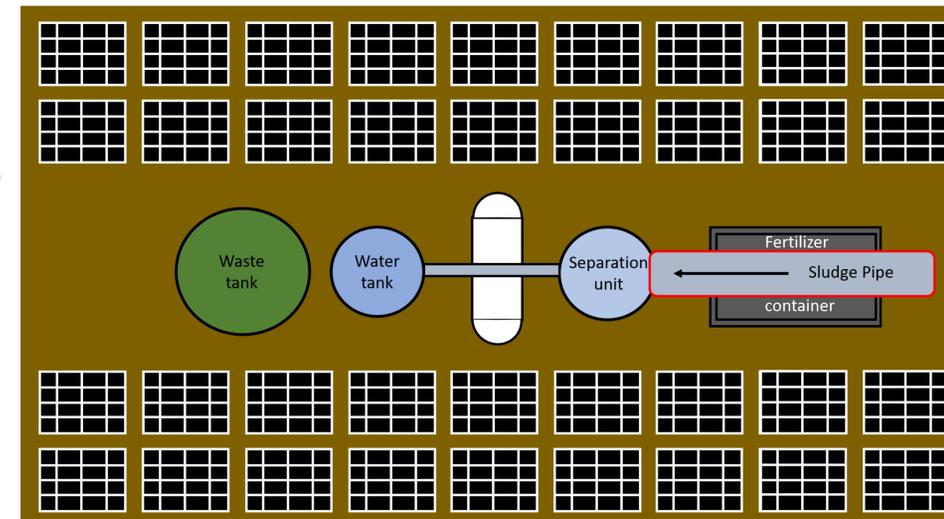
## Prototype Design



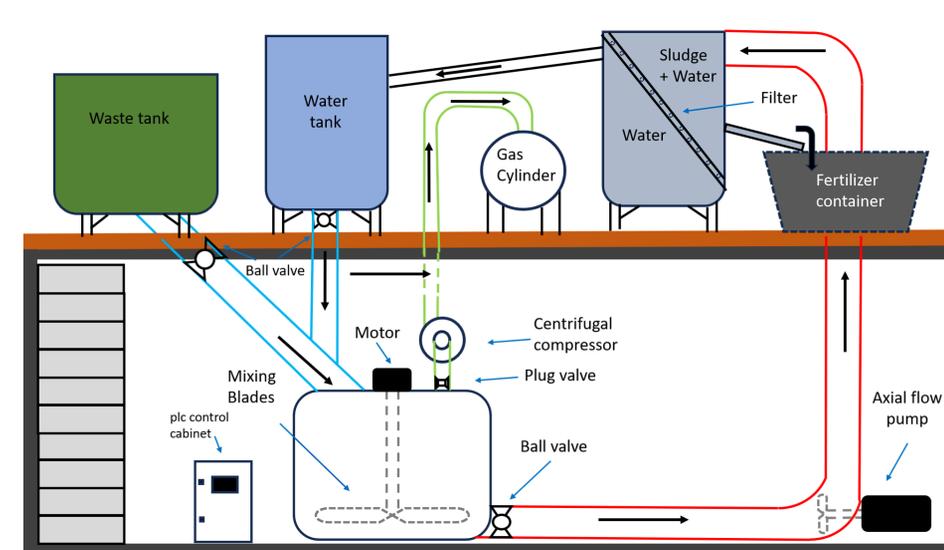
## PID



## Project Design (Top View)



## Project Design (Front View)



## Key chemical reactions

Hydrolysis:

- Cellulose → Glucose
- Lipids → Fatty acids
- Proteins → Amino acids

Acidogenesis:

- Glucose → Organic acids
- Amino acids → Organic acids
- Fatty acids → Acetyl-CoA → Acetate

Acetogenesis:

- H<sub>2</sub> + CO<sub>2</sub> → Acetate

Methanogenesis:

- Acetate → Methane + CO<sub>2</sub>
- H<sub>2</sub> + CO<sub>2</sub> → Methane + Water

## Conclusion

In harnessing the power of the sun to drive our biogas digester, we have not only embraced sustainable energy solutions but have also pioneered an eco-friendly approach to waste management. Our solar-powered biogas digester exemplifies the fusion of innovation and environmental stewardship, offering a glimpse into a future where renewable resources shape a cleaner, greener world.