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## Fermentation of Manure

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How to Improve Biogas Production

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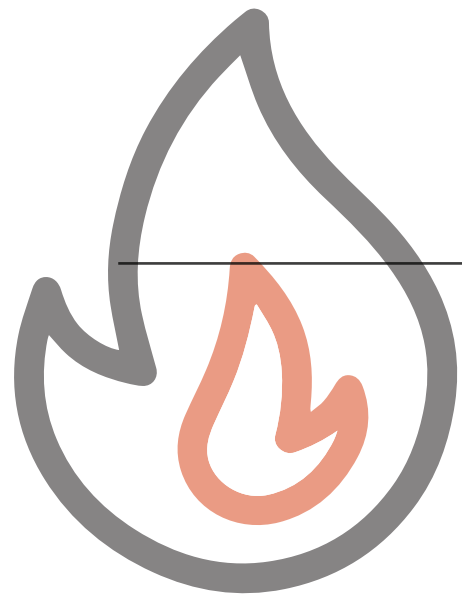
# Farment BioSolutions Proposal

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This presentation details the fermentation system proposed by Farment. It includes information on biogas, anaerobic digestion, and components of the current system.

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## What is Biogas?



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- > Biogas is a mixture of methane, CO<sub>2</sub>, and small quantities of other gases.
  - > It is produced by the anaerobic digestion of organic matter in an oxygen-free environment.
  - > Biogas is considered an eco-friendly fuel because it can help to reduce greenhouse gas emissions and the world's dependency on fossil fuels.
  - > With minor cleanup, biogas can be used to generate electricity and heat.
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## What is liquid anaerobic digestion?



- > Anaerobic digestion is a process through which bacteria break down organic matter in the absence of oxygen.
- > Organic matter such as animal manure, wastewater biosolids, and food wastes
- > Wet anaerobic digestion systems are designed to process biodegradable feedstock into a digestate slurry that typically has less than 15% total solids.
- > For feedstock with a higher percentage of total solids, the mix is diluted with fresh water, re-circulated processed water, or another form of organic waste with a lower percentage of total solids.
- > This could include co-digestion, which is covered on the next slide.

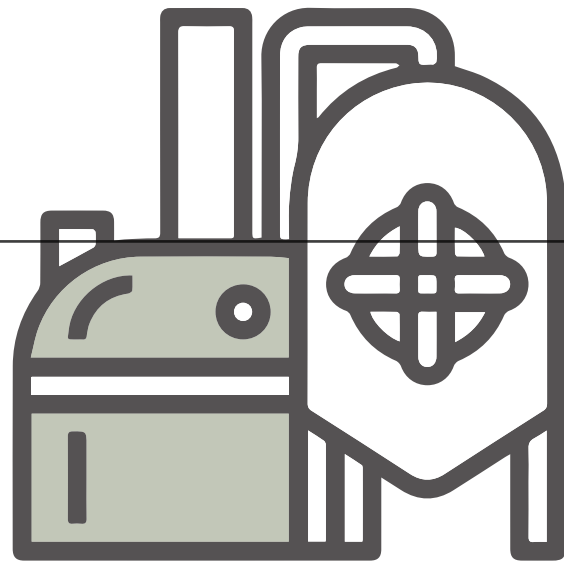
## What is co-digestion?



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- > Co-digestion is a process whereby energy-rich organic waste materials are added to dairy of wastewater digesters with excess capacity.
- > Examples of energy-rich organic waste include:  
Fats,  
Oils,  
Grease,  
Food Scraps.
- > Co-digestion can increase methane production from materials that are low-yielding or difficult to digest.
- > Significant benefits include enhanced system stability and methane yield

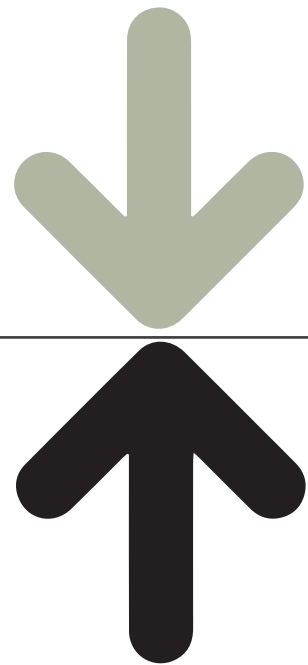
## What is dry anaerobic digestion?



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- > Dry anaerobic digestion is digestion with a total solid percentage higher than 20% content in the reactor.
- > This is suitable for agricultural wastes such as crop residues and livestock wastes.
- > Advantages of dry anaerobic digestion include:
  - Less maintenance*
  - Lower amount of water*
  - Use of various substrates per unit of digesters*
- > The differences between wet and dry anaerobic digestion will be further examined in the next slide.

## Anaerobic Digestion: Wet versus Dry

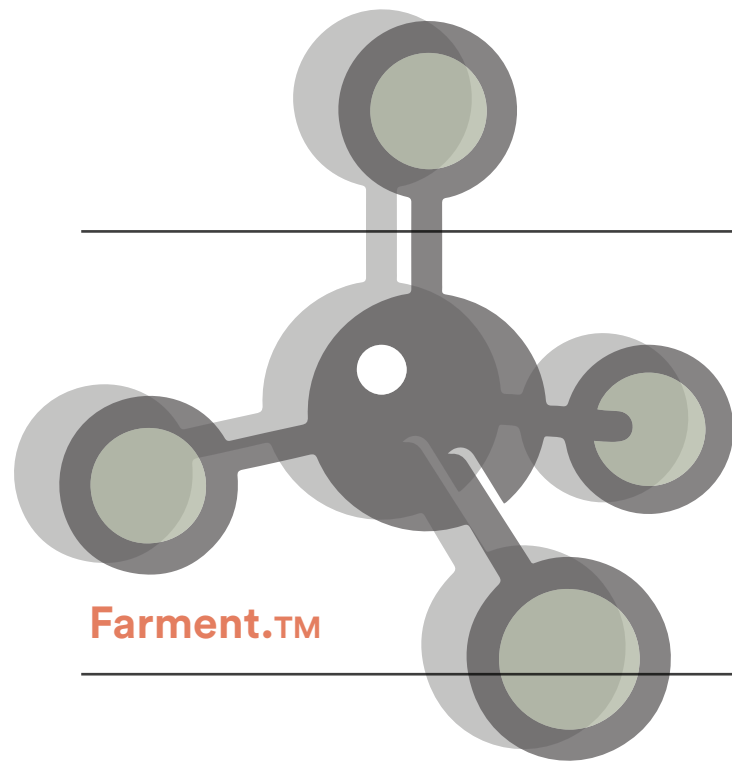


- > In wet anaerobic digestion, the feedstock is pumped, heated, and stirred at a content of 5-15% total solids.
- > In dry anaerobic digestion, with a content of over 15% solids, it can be stacked with leachate sprayed over the top.
- > This percolates through the material, breaking it down over a longer retention time.
- > Wet digestate is pumpable, while dry digestate is removed with a loader.
- > Dry anaerobic systems tend to be more expensive than wet anaerobic systems.
- > Most biogas plants worldwide utilize liquid-type anaerobic digestion.





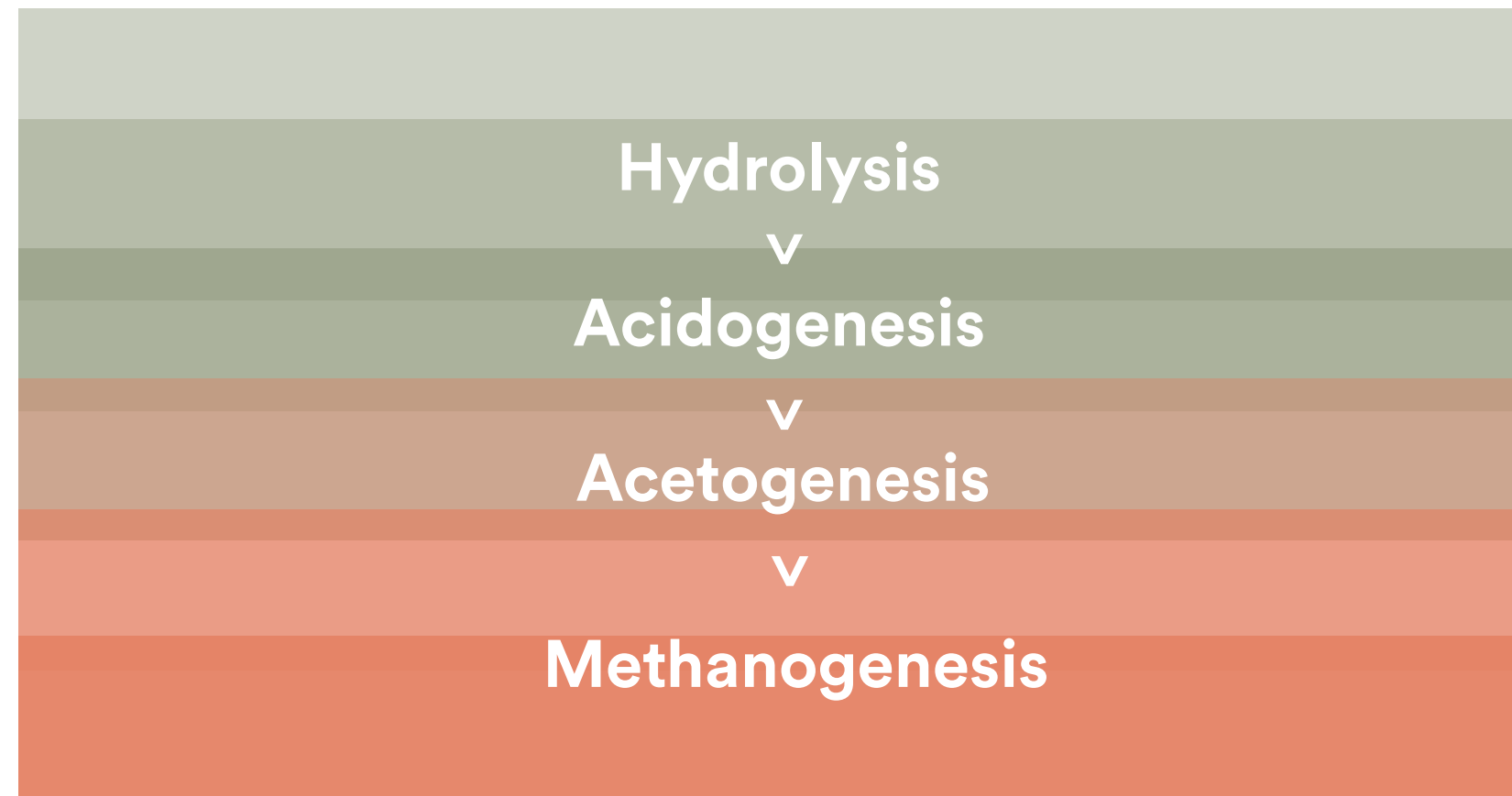
## What is biogas fermentation?



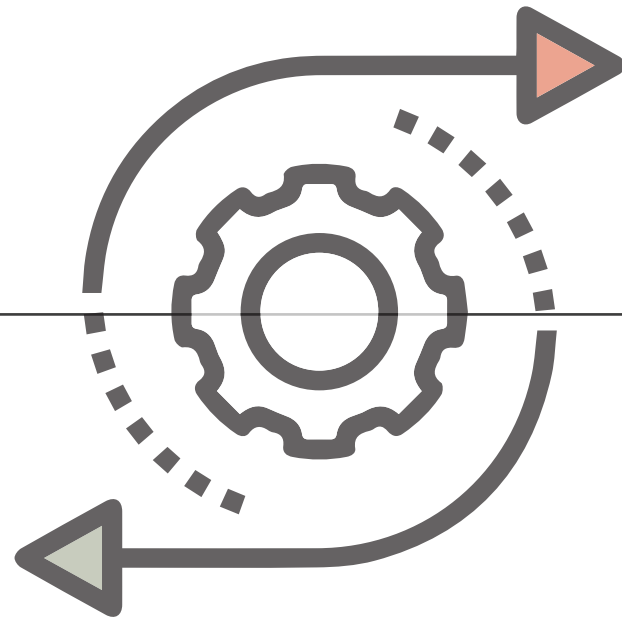
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- > Biogas fermentation is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen.
- > Biogas consists mainly of methane ( $\text{CH}_4$ ) and carbon dioxide ( $\text{CO}_2$ ).
- > Advantages of biogas:
  - 100% renewable (no new carbon)*
  - Transportable*
  - Storable*
  - Permanently available*

# Biogas Fermentation Process



## Fermentation with hybrid co-digestion



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- > It is produced by the anaerobic digestion of organic matter in an oxygen-free environment.
- > Biogas is considered an eco-friendly fuel because it can help to reduce greenhouse gas emissions and the world's dependency on fossil fuels.
- > With minor cleanup, biogas can be used to generate electricity and heat.

## How does it work?



- > First, a low pH dry fermentation with specific Farment inputs will produce a base of approximately 40 liters of biogas per kilogram of inputs.
- > This is a thermophilic process, which means it will have an operational working temperature of 50°C or 122°F.
- > In this process, inputs will lose approximately 20% of total weight, and the moisture will condense as a liquid loaded with volatile solids.
- > After 7 – 12 days, a portion of these liquids will be extracted and mixed with the Farment culture and other inputs, allowing it to continue producing biogas with a liquid digester.

## How does it work?

(continued)

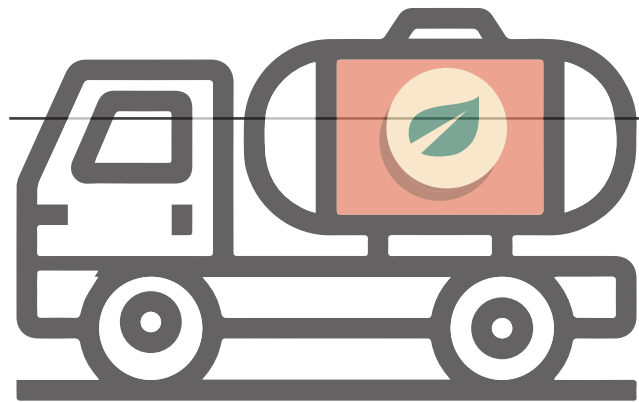


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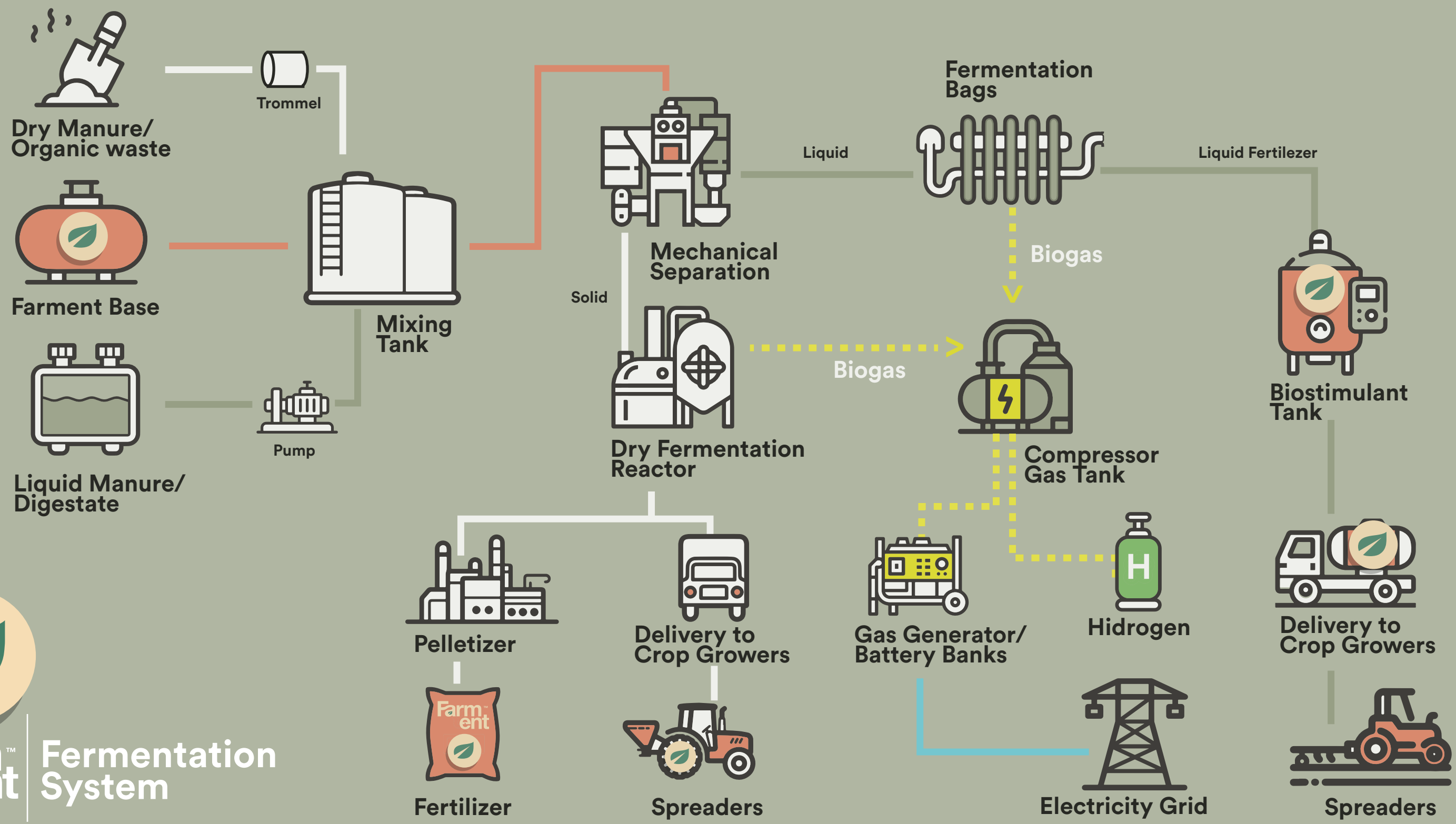
- > The liquid digester will have a rich mixture and is expected to produce approximately 60 liters of biogas per kilogram of inputs.
- > After being digested in the dry fermentation segment, the remaining solids will be mixed with Farment-specific cultures and processed for 7 days to convert the remaining solids into a high-quality fertilizer.
- > After extracting the biogas, the remaining liquid will be used as a fermentation starter in the dry fermentation segment.
- > This constantly recycles fluids and gives a whole new meaning to nutrient circularity.

## Farment Liquid Fermentation System - Biobags



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- > Dimensions for the liquid portion: 16 × 2.2 × 0.9 meters or 52.5 × 7.21 × 2.95 feet
- > Total volume: 40 cubic meters or 1,412 cubic feet
- > Gas storage volume: 8.3 cubic meters or 224 cubic feet
- > Total input volume: 31.7 cubic meters or 1,119 cubic feet
- > Annual reactor capacity: 158 metric tons each
- > Reactors per hectare: up to 210 (84 bags per acre)



**Farm-ent**™ Fermentation System



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**Thank you!**

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Feel free to ask any  
additional questions.