

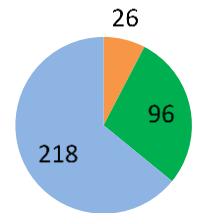
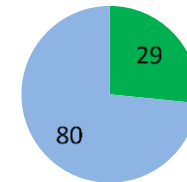
# PA Biogas Market

- #9 among U.S. states for methane production potential from biogas sources
- PA's full biogas potential:
  - \$1 billion in new capital investments AND
  - 8,700 short-term construction jobs, 696 permanent jobs, and numerous industry-supporting jobs in the supply chain AND
  - Enough electricity to power 151,586 homes (2 billion kWh) or enough renewable natural gas to fuel 151,586 vehicles.
  - AND
  - reduce greenhouse gas emissions by the equivalent of 18.1 trillion tons of carbon dioxide, the same as growing 35.6 million tree seedlings for ten years or the amount 1,187,211 acres of U.S. American forest sequester each year.

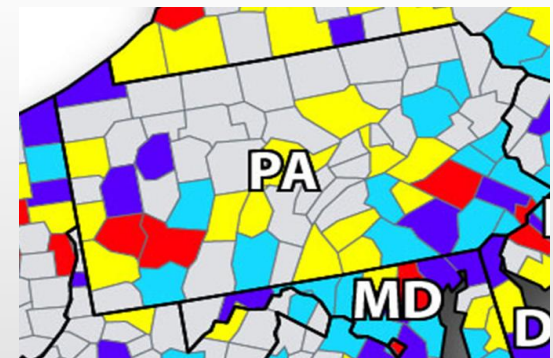
## Operational Digesters    Potential Digesters

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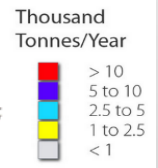
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Food Waste    Agriculture    Waste Water



This analysis illustrates the methane generation potential by county from the following biogas sources: landfills; animal manure; wastewater treatment; and industrial, institutional, and commercial organic waste (IIC).



American Biogas Council, <http://www.americanbiogascouncil.org/stateprofiles.asp>



## Organic material is delivered to the digester system

This may include animal manure, food scraps, agricultural residues, or wastewater solids.

*Digested material may be returned for livestock, agricultural and gardening uses.*



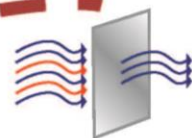
## Organic material is broken down in a digester

The digester uses a natural biological process under controlled conditions to break down organic material into products for beneficial use or disposal.

*Some biogas can be used to heat the digester.*

**BIOGAS**

**DIGESTED MATERIAL**



## Raw biogas is processed

Typically, water, carbon dioxide and other trace compounds are removed, depending on the end use, leaving mostly methane.



## Processed biogas is distributed and used

The gas may be used to produce heat, electricity, vehicle fuel or injected into natural gas pipelines.

*Liquids and solids may be separated.*

**SOLIDS**

**LIQUIDS**



## Digested material is processed and distributed

Solids and liquids from the digester may be used to produce marketable products, like fertilizer, compost, soil amendments or animal bedding.

### organic material

Organic materials are the "input" or "feedstock" for a biogas system. Some organic materials will digest more readily than others. Restaurant fats, oils and grease; animal manures; wastewater solids; food scraps; and by-products from food and beverage production are some of the most commonly-digested materials. A single anaerobic digester may be built for a single material or a combination of them.

### the digester

An anaerobic digester is one or more airtight tanks that can be equipped for mixing and warming organic material. Naturally occurring microorganisms thrive in the zero-oxygen environment and break down (digest) organic matter into usable products such as biogas and digested materials. The system will continuously produce biogas and digested material as long as the supply of organic material is continuous, and the temperature inside the system

### biogas processing

Biogas is mostly methane, the primary component of natural gas, and carbon dioxide, plus water vapor, and other trace compounds (e.g. siloxanes and hydrogen sulfide). Biogas can replace natural gas in almost any application, but first it must be processed to remove non-methane compounds. The level of processing varies depending on the final application.

### biogas distribution

Processed biogas, often called "biomethane" or "renewable natural gas," can be used the same way you use fossil natural gas: to produce heat, electricity, or vehicle fuel, or to inject into natural gas pipelines. The decision to choose one use over another is largely driven by local markets.

### digested material

In addition to biogas, digesters produce solid and liquid digested material, containing valuable nutrients (nitrogen, phosphorus and potassium) and organic carbon. Typically, raw digested material, or "digestate," is processed into a wide variety of products like fertilizer, compost, soil amendments, or animal bedding, depending on the initial feedstock and local markets. These "co-products" can be sold to agricultural, commercial and residential customers.