# Air Permitting and Cogeneration-Strategies for Compliance While Reducing CO2 Emissions

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## Goals: Moving Towards Energy Self-Sufficiency and GHG Reduction

- Increase Process Energy Efficiency
- On-Site Energy Co-Generation
  - Biogas utilization
  - Increase anaerobic digestion efficiency
- Processing of restaurant trap grease & food waste
  - Increase biogas production
  - Conversion to Biogas: widely used in Europe; In US California is at the forefront.
  - Additional revenues (tipping fee)
- Reduce green house gas (GHG) emissions

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## Anaerobic Sludge Digestion

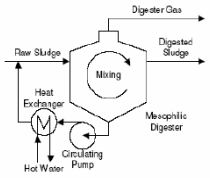
Biosolids (primary sludge & waste activated sludge) can be processed in anaerobic digesters where microorganisms stabilize them (in the absence of oxygen), reduce the mass and yields "biogas".

Biogas refers to a gas produced by the biological breakdown of organic matter in the absence of oxygen.

Typical digester gas composition: 60% methane & 40% carbon dioxide.

Biogas energy content: 600 BTU/ft3

**Note:** Natural Gas Energy content is 1,000 BTU/ft3

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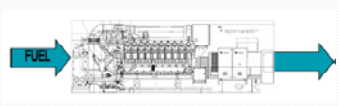
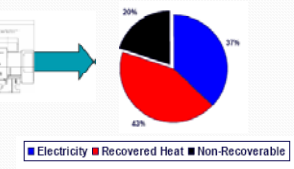
## Biogas Utilization

Cogeneration is the **simultaneous production** of useable heat and electrical power from a single fuel source in one piece of equipment. It is referred to as Combined Heat & Power (CHP).




Internal Combustion Engine
Fuel Cell
Micro-turbine
Gas Turbine
Steam Turbine
Rankine Engine

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## Air Permitting Issues

- New Jersey – with its poor air quality – has many restrictions on the emissions from combustion and power generation.
  - Commercial Power Generation Plants (Combustion) – have significant air pollution controls in place
  - NOx is a significant concern, but so are SOx, Formaldehyde, VOCs and others.
  - May require gas pretreatment (Siloxanes? Sulfides?)

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## Air Permitting Issues

- Compliance with air permitting requirements for a WWTP with a biogas cogeneration system is complicated
- NJDEP may require exhaust stream testing or continuous monitoring of the exhaust stream to ensure compliance. This can result in significant laboratory testing fees
- If you aren't already, your facility may become a MAJOR FACILITY
- This means a Facility-wide Operating Permit (Title V)
- ENFORCEMENT!!!
- REPORTING!!!

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## Anaerobic Digestion & Co-Generation GHG Reductions

- Anaerobic digesters make several contributions to climate change mitigation:
  - Methane is a potent GHG with a global warming potential 23-25 times that of $CO_2$.
  - When biogas is combusted, methane is converted into $CO_2$ and water, resulting in a net GHG emissions reduction.

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## Anaerobic Digestion & Co-Generation GHG Reductions

- Anaerobic digesters make several contributions to climate change mitigation:
  - Displacement of fossil fuel-based energy that occurs when biogas is used to produce heat or electricity
  - GHG emissions are also reduced when the nutrient-rich digestate created from anaerobic digestion is used to displace fossil-fuel based fertilizers
  - BSG experience – 100 MGD plant had a REDUCTION of 52,000 TPY GHG ($CO_2$ eq)

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## Maximize the Benefits - FOG

- Fats, Oils and Grease
- Processing of restaurant trap grease & food waste
  - Increase biogas production
  - Conversion to Biogas: widely used in Europe; In US California is at the forefront.
  - Every step has a corresponding GHG reduction; clean-ups, transportation, disposal
  - Additional revenues (tipping fee)

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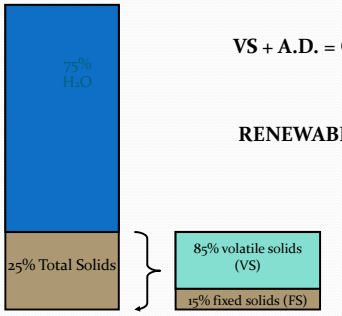
## Fats Oil & Grease (FOG) + or Food Waste Energy Potential




**VS + A.D. = $CH_4$ + $CO_2$**

**RENEWABLE ENERGY!!!**

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## Maximize the Benefits - FOG

- Municipalities currently spend anywhere from $10,000 per year to as much as $50-100,000 per year for cleaning up blockages from grease clogs in gravity fed wastewater lines. By creating a value to the grease trap wastes, BSG believes facilities can reduce this burden while also saving local businesses money by reducing the cost associated with proper grease trap maintenance.

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## GHG Reductions - FOG

- Increase biogas production = Increased onsite energy production via the cogeneration system = increased energy savings and carbon off-set
- Benefit participating municipalities (by reducing grease clogging and maintenance costs)

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## GHG Reductions - FOG

- Cut the costs of providing grease trap maintenance to local restaurants and businesses
- Will result in significant greenhouse gas reductions that could be potentially traded in the future.
- Additional revenue (via a tipping fee)

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## Maximize the Benefits - Food Wastes

- Food waste is roughly equivalent to 18-30% of the municipal solid waste stream.
- In the US, more than 30 million tons of food waste are sent to landfills annually, and less than 3% is diverted from landfills, according to the U.S. EPA.

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## Maximize the Benefits - Food Wastes

- Food waste in landfills =
  - No Resource Recovery
  - Early uncontrolled $CO_2$ and methane emissions
  - Capture of landfill biogas is less efficient than from an enclosed digester

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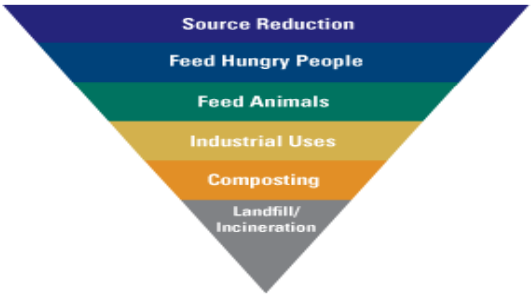
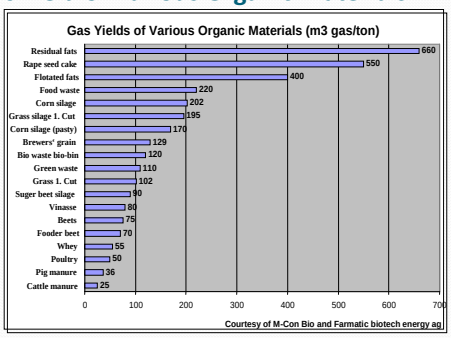
## U.S.E.P.A. – Hierarchy of Food Waste




## Biogas Yield of Various Organic Materials

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## This? (Landfill)

## Or This? - Food Waste Digester

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## Maximize the Benefits - Food Wastes

- Evaluating types of food/organic wastes for anaerobic digestion for additional biogas and energy production instead of disposing food waste in municipal landfills - the potential result?:
  - Potentially significant increases in methane and renewable energy production
  - Significant greenhouse gas reductions
  - Additional Tipping fees & disposal cost savings to the participating municipalities and Counties

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## CONCLUSIONS

- Anaerobic digestion/Co-generation has the potential to:
  - Recover the energy value of organic wastes
  - Potentially significant increases in methane and renewable energy production
  - Develop new revenue sources
  - Save landfill space
  - Reduce waste disposal costs
  - Significant greenhouse gas reductions

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## QUESTIONS?

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