Diverting Food Waste from Landfills for the Production of Biogas

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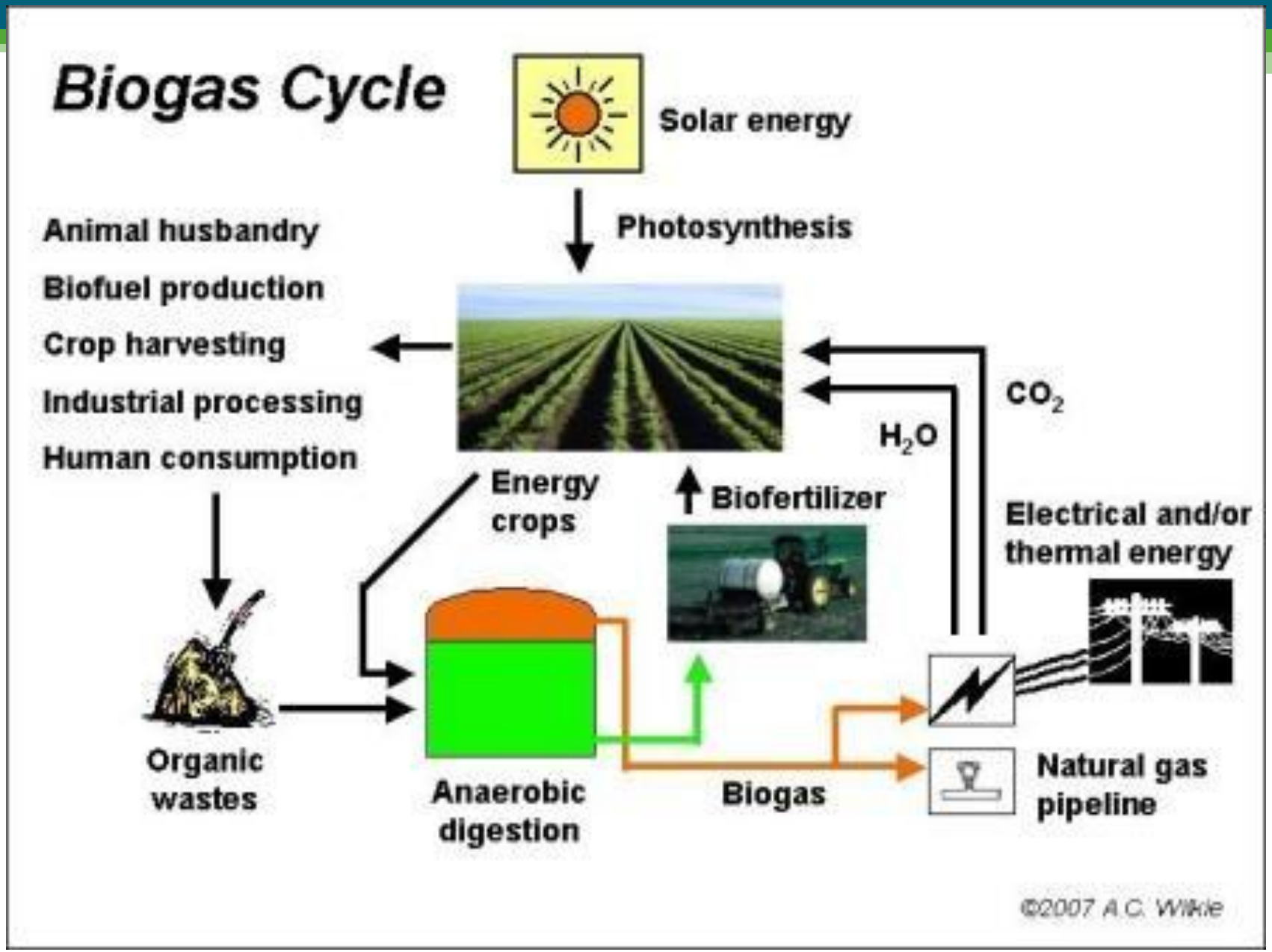
What is biogas?

- Gaseous by-product from anaerobic digestion of organic material
- Formed through bacterial metabolism
- Relatively efficient process
- 60-85% methane, 15-40% CO_2, <1% hydrogen sulfide
- Nutrients are retained as an organic fertilizer


Biogas Cycle
Solar energy
Photosynthesis
Animal husbandry
Biofuel production
Crop harvesting
Industrial processing
Human consumption
CO_2
H_2O
Energy crops
Biofertilizer
Electrical and/or thermal energy
Organic wastes
Anaerobic digestion
Biogas
Natural gas pipeline
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Why food waste?

- 63.4 billion pounds/year in the US or 12.5% of the municipal waste stream (US EPA)
- Produced throughout community
- Relatively untapped resource

Food waste in Florida

- 1.7 million tons per year, 6% of the state's unrecycled municipal solid waste (FDEP)
- Only 1% recaptured

Florida food waste sources

- 80,935 food service vendors
- 9,789 food store producing 625,000 tons annually
- Other locations: schools, prisons, processing plants, residences

Objectives

1. Spread awareness of the potential of food waste diversion for biogas.
2. Estimate food waste throughout Florida.
3. Develop protocol for pretreatment of food waste for anaerobic digestion.

Methodology: Objective 1

- Design and build portable digester for public displays
- Locations include conferences (NAWTEC, SWANA) and tabling events (Earth Day, University events)
- Self-contained with interpretation
- Spreads awareness and public support for the project

Methodology: Objective 2

- Estimate state-wide sources and amounts of food-waste
- Collect current, available data on food waste
- Conduct food waste audits at different locations (restaurants, grocery stores)
- Determine full potential of biogas from food waste in Florida

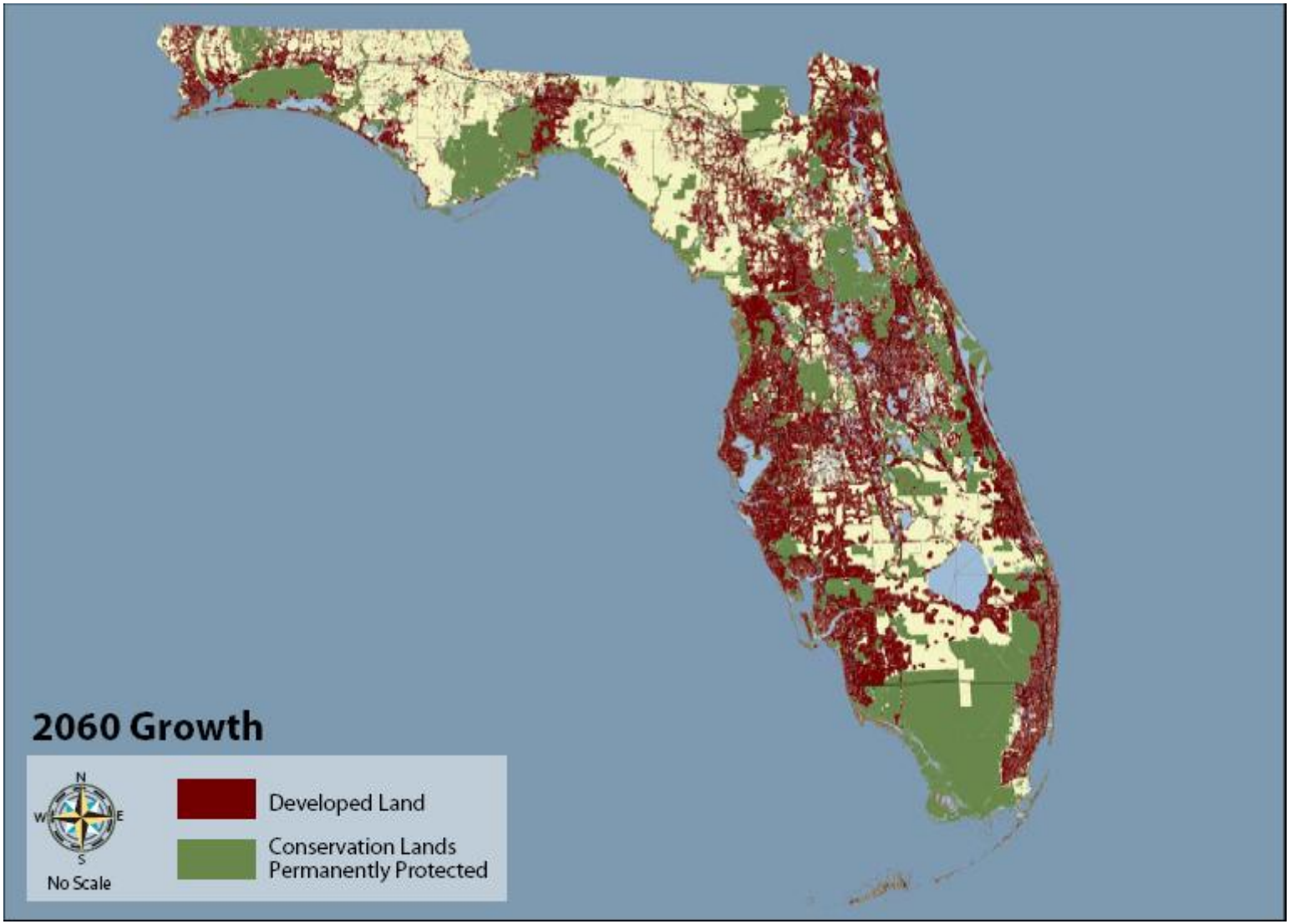
Methodology: Objective 3

- Pretreatment of food waste is important in optimizing digestion
- Current treatment methods are energy intensive
- Study and develop practical methods for optimum operating procedures

Benefits

- Reduces waste entering landfill
  - Frees space for other wastes
  - Extends lifetime of landfill
  - Lessen need to open new landfills

Florida is running out of land



Source: 1000 Friends of Florida

Benefits

- Reduces volume and pollutants of leachate
  - Food waste has high moisture
  - Organic material leads to COD and BOD in leachate
  - Decomposition causes nitrogen to leach
  - Food waste is major source of these in landfills

Benefits

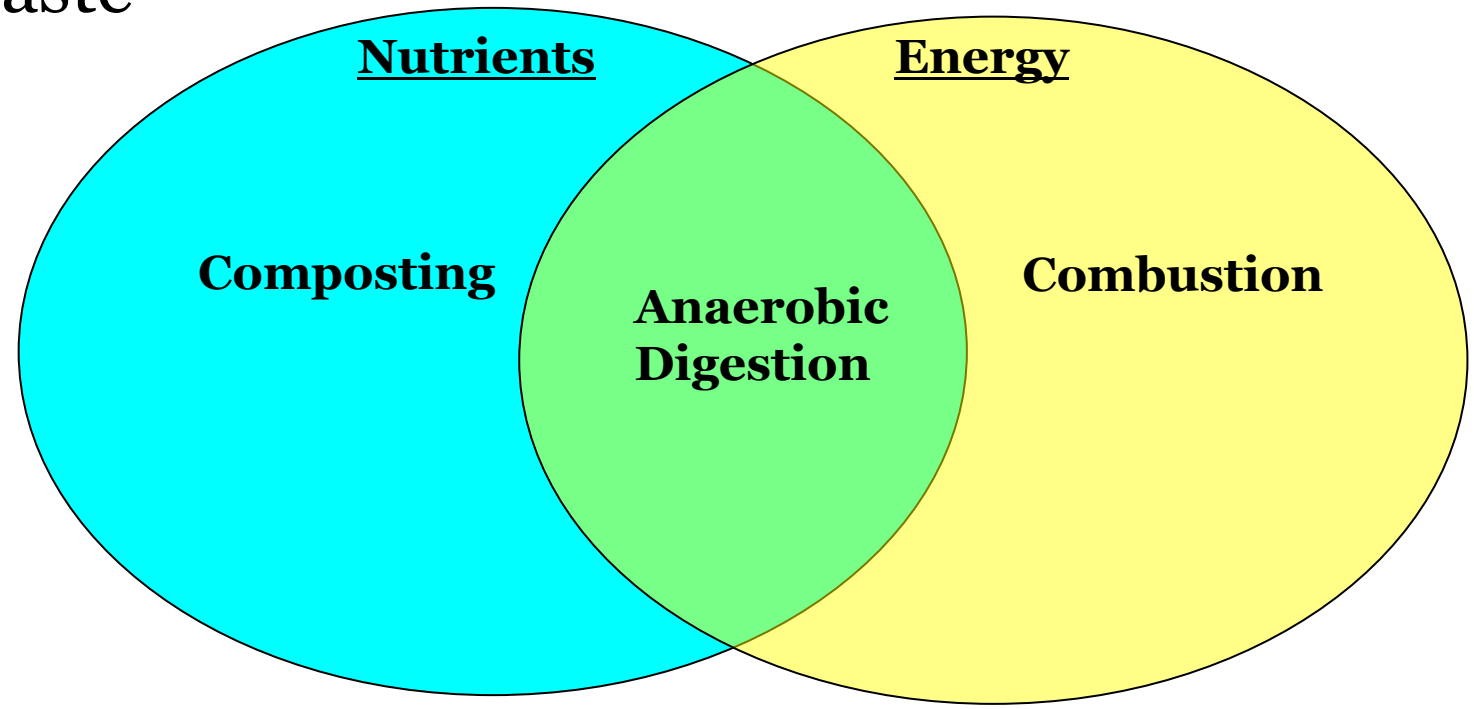
- Reduces methane emissions from landfills
  - Methane is strong greenhouse gas
  - Landfill contribute 23% of US methane emissions (EPA)
  - Food waste in a landfill produces 300 cubic meters of methane per dry ton
  - Removing food waste eliminates these emissions

Benefits

- Cleaner, more efficient than landfill gas
  - Biogas has less contaminants than landfill gas (100-150 ppm hydrogen sulfide)
  - Methane is produced faster in anaerobic digesters
  - More methane is produced than in landfills (360-450 vs. 300 cubic meters/dry ton)
  - Future of landfill gas technology

Benefits

- Captures both energy and nutrients from food waste

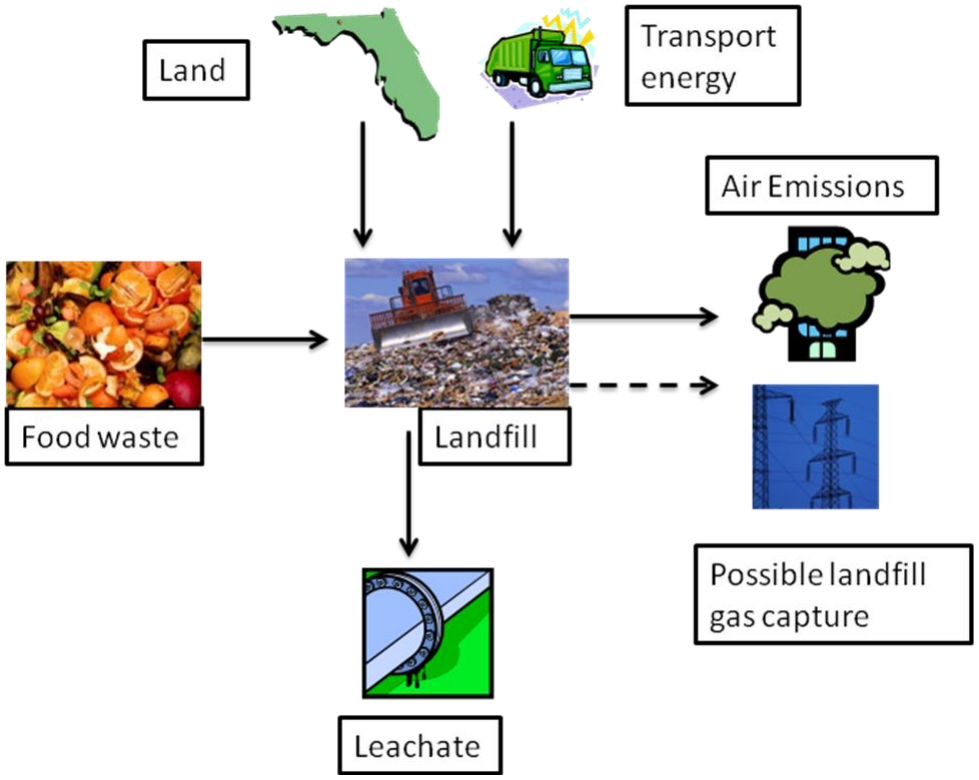


Benefits

- Bioenergy by-products can be digested
  - Glycerol and press-cake from biodiesel production are excellent feedstocks
  - Ethanol by-products can also be used
  - Potential integration and expansion of anaerobic digestion
  - Solves waste-handling problem of liquid biofuels

Conclusion

- Current open-loop food-waste-to-landfill system



Conclusion

- Proposed closed-loop food-waste-to-biogas system