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Power of We™

Organics to Wheels: *Anaerobic Digestion of Source Separated Organics for RNG*

Energy Vision & Pace Energy and Climate Center
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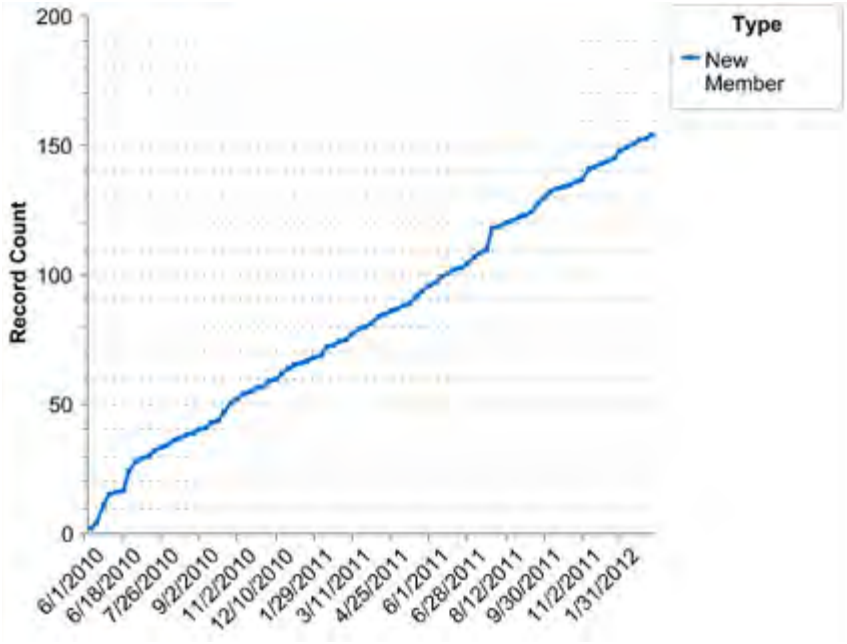
Agenda

- Harvest Power background
- Overview: Food Scraps to Vehicle Fuel Pathway
- Case Studies
- Lessons Learned

American Biogas Council: The Voice of the US Biogas Industry

- The **only** U.S. organization representing the biogas and anaerobic digestion industry
- **160Organizations** from the U.S., Germany, Italy, Canada, Sweden, Belgium and the UK
- **All** industry sectors represented:
  - Landowners
  - Fuel refiners
  - Manufacturers
  - Project developers
  - Biogas users
  - Plant owners
  - Financiers
  - EPC firms
  - Wastewater
  - Utilities



Growth in ABC Membership

American biogas Council

Dedicated to Maximizing the Production and Use of Biogas from Organic Waste

About Harvest

Harvest harnesses the maximum value from organic materials through the production of renewable energy and soils, mulches and natural fertilizers.

Corporate Profile

- Operates 28 processing facilities in North America with more than 430 employees
- Owns and Operates 15 facilities in NY – NJ – CT region
- Manages more than 2 million tons of organic materials, largest composter of yard & food organics in North America
- Sells more than 28 million bags and more than 1 million cubic yards of soils, mulches and natural fertilizers
- Commissioning two AD-to-energy plants in 2012, one in 2013.

The Harvest Organics Operating System™

Harvest: Serving Regional Markets

Regional Clusters

Sites

- 5 Composting
- 3 Bio-Energy
- 2 Wood Waste Recycling
- 14 Transfer Stations/ Retail Yards
- 4 Bagging Sites

Serving

- 40+ Municipalities and Counties
- 700+ Retail Outlets
- 400+ Businesses
- Millions of Backyards

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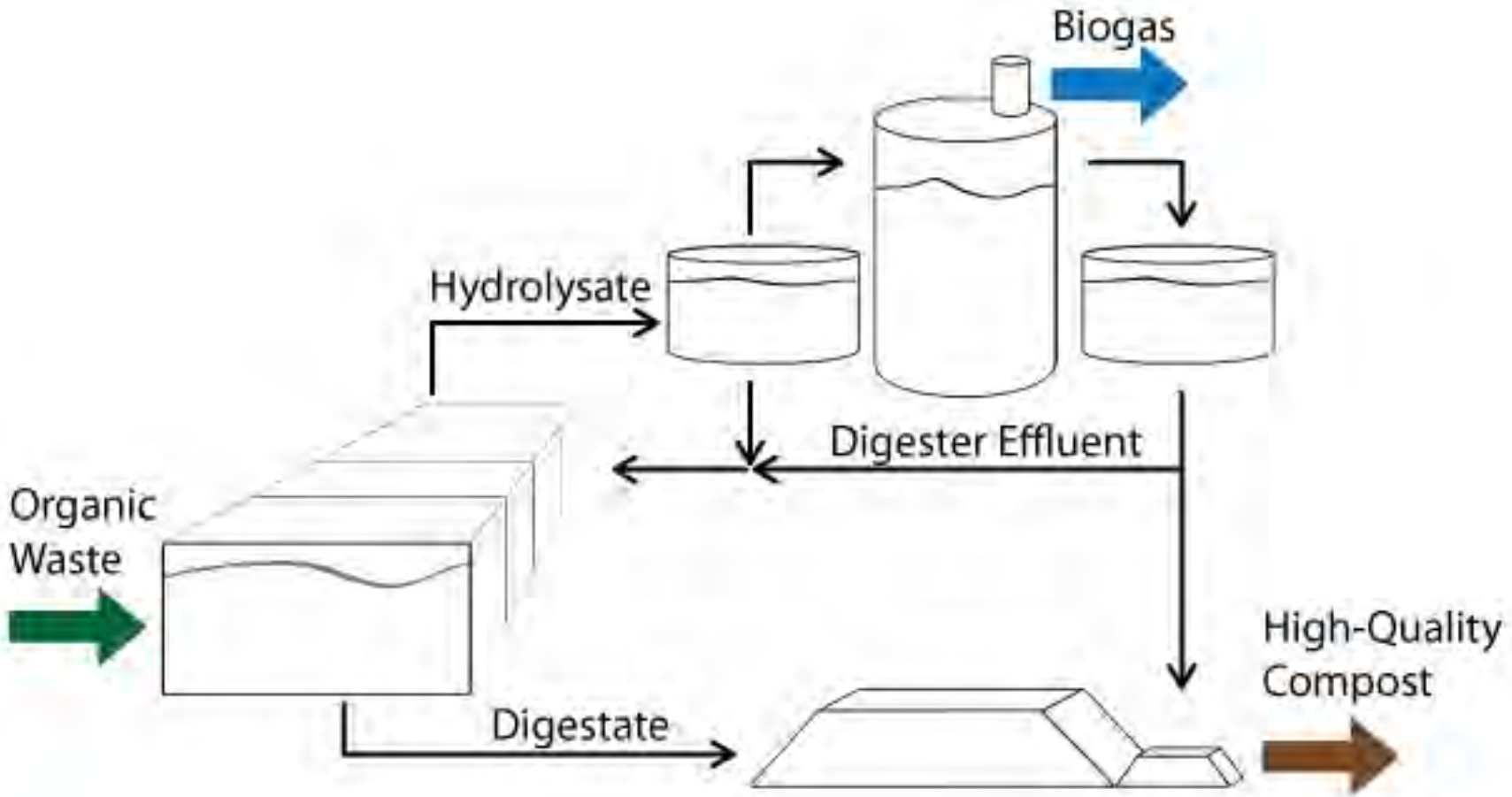
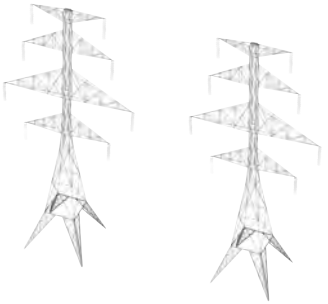
Simplified Process Flow: Biogas Production



Simplified Process Flow: Energy Conversion

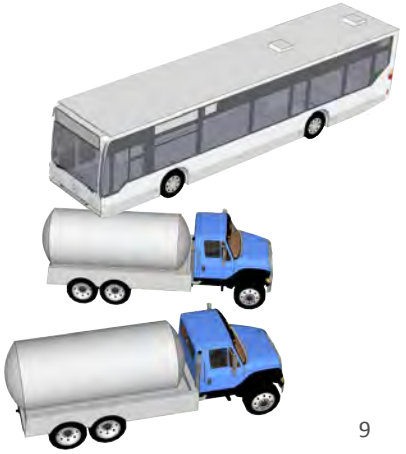
Biogas

Combined Heat & Power (CHP) → Electricity & Heat



Upgrading → Pipeline Natural Gas

Upgrading & Compression → Bio-CNG Fueling



Solutions: High and Low Solids AD

CORE ANAEROBIC DIGESTION OPTIONS

Characteristic	HSAD	LSAD
Solids Content	High solids (stack)	Low solids (pump)
Temperature	Mesophilic (95° - 104°F)	1st Phase Thermophilic (131° - 140°F) Hydrolysis followed by 2nd Phase Mesophilic AD
Process	Batch or Continuous	Continuous
No. of Stages	Multi-stage	Multi-stage
Schematic		

Feedstock Drives AD Technology Selection

The locally-available feedstocks and their relative tip fees determine which AD technology will be operationally suitable and economically profitable.

Characteristic	High Solids AD	Low Solids AD
Ideal waste stream types	Solid food wastes (including SSO, commercial/industrial and some FOG) and yard/wood wastes	Dewatered residuals, food waste, manure, FOG, liquid organic wastes
Solids content of overall mix	25-50%	5-15% (any greater requires dilution)
Contamination levels	Can be higher due to fewer moving parts; contaminants are removed post-AD	Lower due to pumping of material; requires pre-processing of feedstock to remove contaminants

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High Solids Case Study:
Harvest Energy Garden – Richmond, BC

Key Statistics

Start-Up: Autumn 2012

Capacity: 30,000+ tons /yr. organics (mixed food & yard waste)

Energy Output: 2.2 MW combined heat-and-power

Product Output: 21,000 MT /yr. high quality compost

Public Outreach: Visitor Center to host educational tours and promote Zero Waste

Low Solids Case Study:

Harvest Energy Garden - London, Ontario

Key Statistics

Start-Up: Autumn 2012

Capacity: 70,000 tons /yr. ICI (Institutional, Commercial, Industrial) organics

Energy Output: 5 MW combined heat-and-power

Product Output: 5,200 MT / yr. granular fertilizer

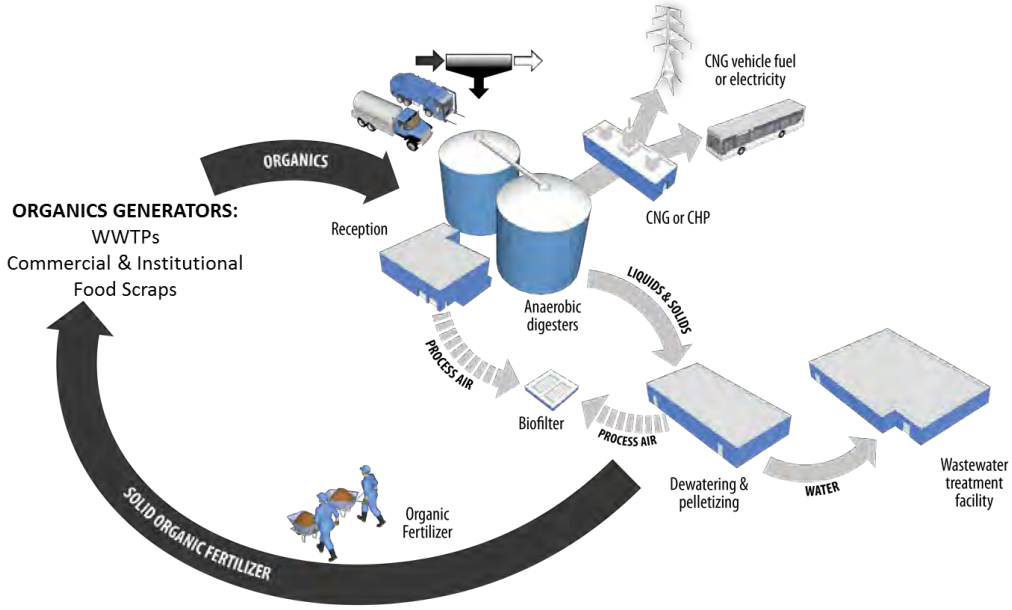
Customers: Commercial food processors, grocery stores, restaurants, rendering plants.

Low Solids Case Study:
Florida Energy Garden Overview

Harvest's Energy Garden will co-digest food wastes from local tourist and resort locations with thickened waste activated sludge from the adjacent, publicly-owned waste water treatment plant (WWTP) to produce baseload renewable energy, fertilizer and soil amendments.

Key Benefits for Municipal Partner

- ✓ Lower electricity costs for waste water treatment plant, under stable, long-term contract
- ✓ Lower disposal costs for waste solids
- ✓ Enhanced economic and environmental sustainability
- ✓ Partnership with municipality to lower cost and create an increase in property tax revenue



Florida Project Description

Harvest is partnering with a Florida municipality to process multiple ***organic waste streams*** to ***generate renewable electricity*** for the municipality's wastewater treatment plant and ***produce fertilizer.***

Project Location	Leased land, adjacent to Wastewater Treatment Plant (WWTP)
Technology	Continuous Low-Solids Anaerobic Digestion (LSAD); Well known technology deployed globally including Harvest facility in Ontario
Target Construction Period	Q3 2012 to Q4 2013
Primary Feedstocks	Thickened Waste Activated Sludge (TWAS), Fats/Oils/ Grease (FOG), Food Waste
Tonnage Input	120,000 Tons per year (tpy)
Renewable Energy	3.2 Megawatts of installed capacity, 20,000 Megawatt-hours / year
Fertilizer Production	3,000 tpy Class "AA" Dried Granular and 500 tpy organic phosphorus

RNG *vs.* Electricity for Energy Conversion

A combination of local market conditions and federal and state incentives drive the choice between converting biogas to RNG for vehicle fuel vs. *producing electricity*

Characteristic	RNG	Electricity
Key Market Dynamic	Competing against low fossil NG prices ***& high petroleum prices***	Competing against low fossil NG prices
Energy off-take	***Best:*** on-site fueling of fleet vehicles ***Possible:*** pipeline sale & transfer to nearby fueling	***Best:*** co-locate with net-metering user ***Possible:*** long-term contract with utility
Federal Incentives	RINs: market value up to $7-$8 per MMBtu*	Investment Tax Credit: 30% of capital cost (private ownership)
State Incentives	Very few	Vary by state: • RECs • Net Metering & Virtual NM • Special procurement rules • Standard offers & tariffs

*Biogas from source-separated organics not yet RIN-eligible, but EPA expected to amend rule soon.

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Lessons Learned

- **AD conversion to transportation fuel** instead of electricity is primarily an **economic decision** – not a technical one

- **Critical success factors** within state/local control:
  - ✓ Community support
  - ✓ Long-term access to feedstocks
  - ✓ Long-term energy off-take agreements

- **Federal incentives can help,** but difficult to count on

- Composting and energy production of organics can be **cheaper than landfilling**

A strong, effective working relationship between local government, state regulators and the project developer/operator paves the way for success

There's a better path for organics — help us get there.

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