

# Biogas to Vehicle Fuel Startup and Operations

Rodefeld Landfill  
Dane County, Wisconsin

Presented by:  
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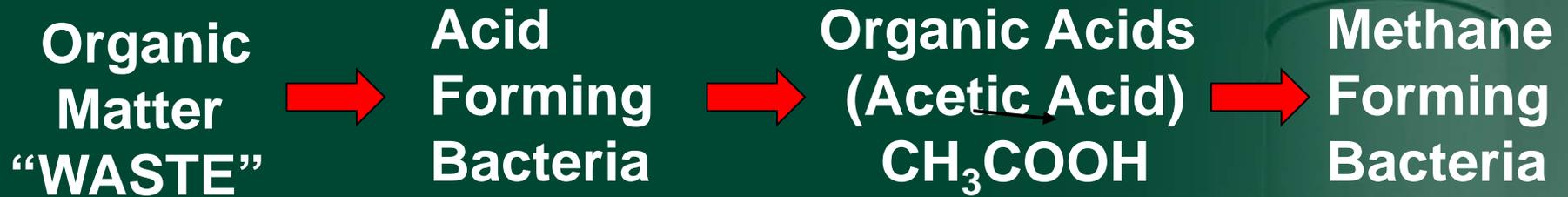
# Biogas Vehicle Fuel Project

- ▶ Dane County, WI Rodefild Landfill
- ▶ Developed with private, municipal and educational entities
- ▶ Purpose is to use biogas as a vehicle fuel on a small scale (100 gge/d).
- ▶ System installation - December 23, 2010

# Overview of Biogas and Utilization as a Vehicle Fuel

- ▶ Biogas : Landfills WWTP, Digesters
- ▶ National: CA, OH
  - Altamont Landfill - LNG California, 3,000 scfm, \$15.5MM
  - SWACO Landfill - CNG Ohio, 200 SCFM, \$4MM
- ▶ Small Scale System Availability?

# The Anaerobic Decomposition Process





Over 12,000,000 CNG vehicles in use worldwide and growing!

Source NGV America

# Manufacturers are Incorporating CNG into Vehicles



Dual Fuel CNG / Gasoline VW Passat



# Cummins Westport Inc

8.9L ISL-G (in-line 6c, 2200 rpm engine)

- Stoichometric combustion w EGR+3-way cat
- .2 NOx/.01 PM – 2010 compliant)
- Engine Ratings

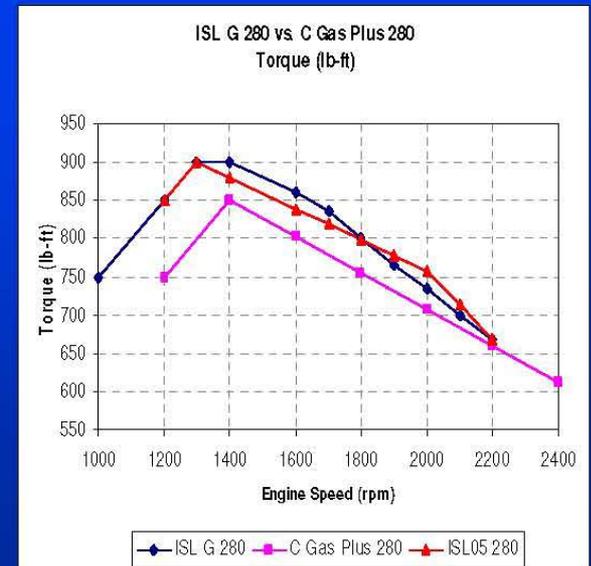
<u>Model</u>	<u>Horsepower</u>	<u>Peak Torque</u>
320	320 @ 2200	1000 @ 1300
300	300 @ 2100	860 @ 1300
280	280 @ 2000	900 @ 1300
260	260 @ 2200	660 @ 1300
250	250 @ 2200	730 @ 1300

- Refuse collection trucks

- Crane Carrier LET, Autocar Xpeditor, Peterbilt LCF 320, Int'l/ALF Condor, Mack TerraPro LE;

- Work /Vocational Trucks

- Freightliner M2-112; Kenworth T8SH and T440; Peterbilt 365 and 384;



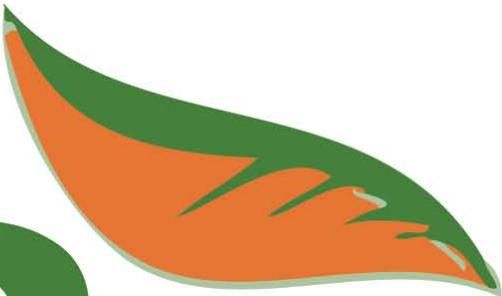
Source NGV America

# Project Considerations

- ▶ Evaluate biogas cleanup technologies
  - resulted in Patent Pending process
- ▶ Viability using biogas as a vehicle fuel as an add-on to an existing 6.4 MW LFGTE System
- ▶ As fuel demand grows blend Natural Gas and BioCNG (similar to biodiesel and ethanol)

# Biogas Treatment Requirements / Considerations

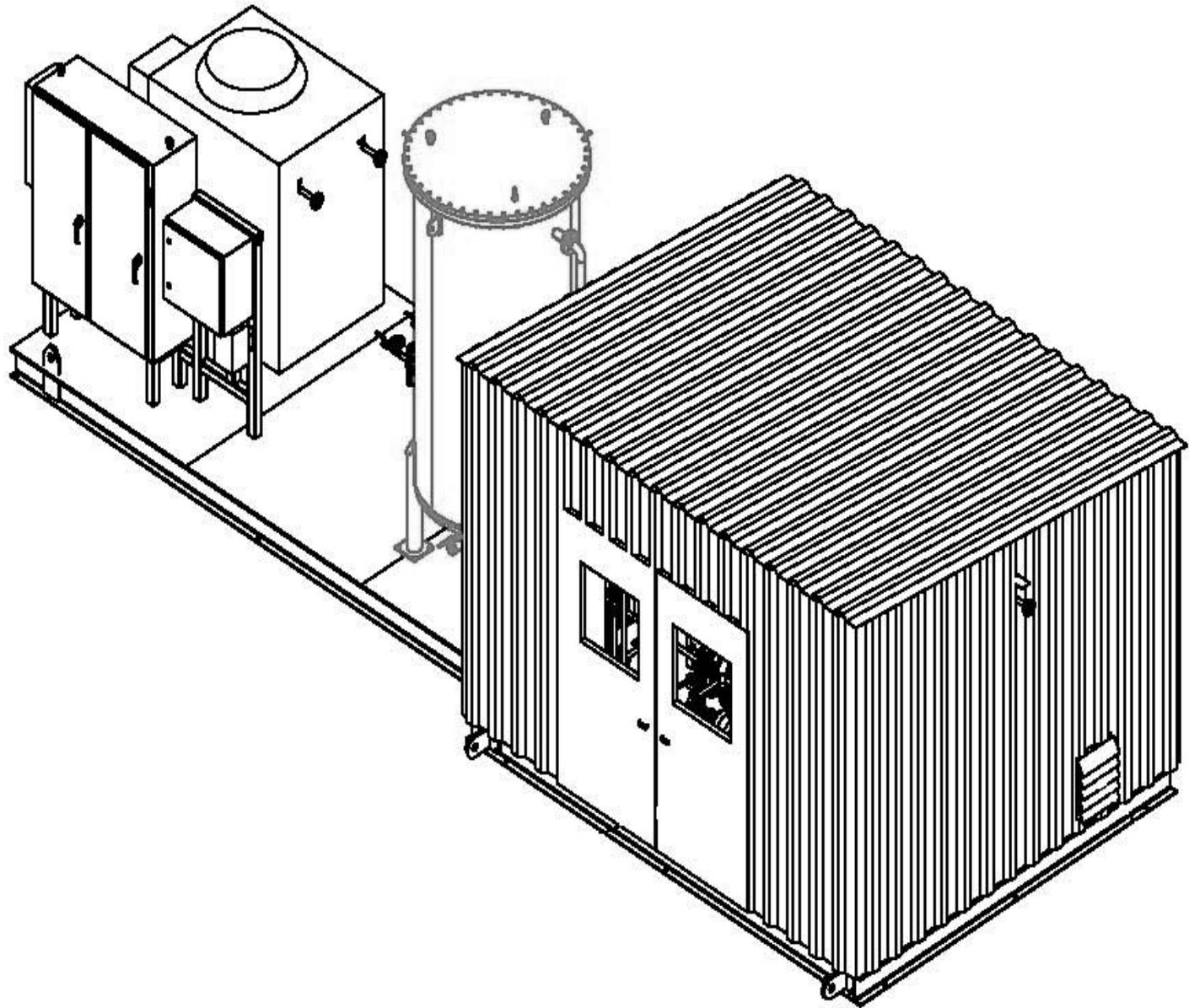
- ▶ Moisture removal
- ▶ Hydrogen Sulfide removal
- ▶ VOC / Siloxane removal
- ▶ CO<sub>2</sub> removal
- ▶ Fuel requirements:
  - ▶ Engine Manufacturers Specifications, SAE J1616



**BioCNG™**



Ford 1998 CNG / Gasoline Pickup Truck  
Purchased By Dane County February 22, 2010





**Fabrication at Unison Solutions  
Dubuque, Iowa  
December 7, 2010**



**System Delivery December 23, 2010**



**System mechanical and electrical connections completed December 27, 2010**



**System Startup December 28, 2010**



**Fueling Station, Fast Fill 60-GGE capacity**

# Biogas Vehicle Fueling Station

## "The Clean Renewable Fuel"



**WARNING**  
STOP MOTOR  
NO SMOKING  
NO OPEN FLAME  
PERMITTED  
FLAMMABLE GAS



**CNG**  
EMERGENCY  
STOP  
BUTTON

**Fueling Station Details**

# Rodefeld Landfill / BioCNG Gas Constituents

Constituent	Units	Inlet LFG	BioCNG
CH <sub>4</sub>	vol. %	55.0	90.0
CO <sub>2</sub>	vol. %	39.5	0.3
O <sub>2</sub>	vol. %	0.5	0.1
N <sub>2</sub>	vol. %	5.0	9.6
H <sub>2</sub> S	ppmv	250	ND

## Notes:

- (1) Data is compiled from field and laboratory analysis of samples collected on January 4, 2011.
- (2) Cummins ISL G engine specifications call for a minimum methane number of 75 CH<sub>4</sub>

# Project Economics

- ▶ 100 GGE/day replacing Gasoline at \$3.25/gal
  - \$110,000 / year avoided cost
- ▶ As Demand for Gas increases Natural gas can be blended at 10% BioCNG = 1000 GGE/day
- ▶ BioCNG production \$0.50 to \$1.00 / GGE
  - Potential for \$0.50 / GGE tax credit
- ▶ Approximate 20 scfm System Cost
  - \$300,000 to \$400,000 for gas conditioning skid
  - \$55,000 for CNG time fill fueling station

(Actual site conditions and SCFM will dictate System Cost)

# What will be learned from the Project

- ▶ **Is BioCNG a reliable vehicle fuel ?**
- ▶ **Ease of production / blending?**
- ▶ **BioCNG production costs ?**
- ▶ **Will staff use CNG vehicles ?**
- ▶ **Public perception of BioCNG?**

# Contact Information

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