WWOA
Dane Co Biogas Vehicle Fueling Pilot Project
BIOMETHANE AS A TRANSPORTATION FUEL
OCTOBER 6, 2011
RODEFELD LANDFILL BIOCNG PILOT PROGRAM

Public/Private Partnership

- Dane County WI - Landfill owner and operator
- Unison Solutions - Biogas treatment system manufacturer
- Cornerstone Environmental Group - Landfill engineering firm
- Alliant Energy - Local gas and electric utility
- ANGI Energy Systems - Portable fueling station
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?**
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)

- Stoichomteric combustion w EGR+3-way cat
- .2 NOx/.01 PM – 2010 compliant

Engine Ratings

<table>
<thead>
<tr>
<th>Model</th>
<th>Horsepower</th>
<th>Peak Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>320</td>
<td>320 @ 2200</td>
<td>1000 @ 1300</td>
</tr>
<tr>
<td>300</td>
<td>300 @ 2100</td>
<td>860 @ 1300</td>
</tr>
<tr>
<td>280</td>
<td>280 @ 2000</td>
<td>900 @ 1300</td>
</tr>
<tr>
<td>260</td>
<td>260 @ 2200</td>
<td>660 @ 1300</td>
</tr>
<tr>
<td>250</td>
<td>250 @ 2200</td>
<td>730 @ 1300</td>
</tr>
</tbody>
</table>

- 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;
BIOGAS VEHICLE FUEL PILOT PROJECT

- Dane County, WI  Rodefeld 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
- Evaluate biogas cleanup technologies
- Use our 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)
THE ANAEROBIC DECOMPOSITION PROCESS

Organic Matter “WASTE” → Acid Forming Bacteria → Organic Acids (Acetic Acid) \( \text{CH}_3\text{COOH} \) → Methane Forming Bacteria

\[ \text{CH}_4 + \text{CO}_2 + \text{Heat} \]

50 to 65%  35 to 50%
BIOGAS TREATMENT REQUIREMENT/CONSIDERATIONS

- Moisture removal
- Hydrogen Sulfide removal
- VOC / Siloxane removal
- CO₂ removal

Fuel requirements:
- Engine Manufacturers Specifications, SAE J1616
FABRICATION FACILITY

BioCNG System Fabrication
ASSEMBLY & TESTING FACILITY

BioCNG Assembly/Testing
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”

Fueling Station Details
Ford 1998 CNG / Gasoline Pickup Truck
Purchased By Dane County February 22, 2010
# Rodefeld Landfill / BioCNG Gas Constituents

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Units</th>
<th>Inlet LFG</th>
<th>BioCNG</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH$_4$</td>
<td>vol. %</td>
<td>55.0</td>
<td>90.0</td>
</tr>
<tr>
<td>CO$_2$</td>
<td>vol. %</td>
<td>39.5</td>
<td>0.3</td>
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<tr>
<td>O$_2$</td>
<td>vol. %</td>
<td>0.5</td>
<td>0.1</td>
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<tr>
<td>N$_2$</td>
<td>vol. %</td>
<td>5.0</td>
<td>9.6</td>
</tr>
<tr>
<td>H$_2$S</td>
<td>ppmv</td>
<td>250</td>
<td>ND</td>
</tr>
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</table>

**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$_4$. 
PROJECT ECONOMICS

- 100 gge/day replacing Gasoline at $3.25/gal
  - $110,000 / year avoided cost ($5/gal is $170K)

- 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
  - $150,000 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?
CITY of JANESVILLE WWTF BioCNG PROJECT

- Janesville WWTF currently has 4-65kW micro-turbines
- Adding an additional 200kW micro-turbine
- Adding the first commercial BioCNG system
- Adding an ANGI compression, storage and fuel dispenser
- System will also operate on natural gas
ANGI Compression and Fuel Dispenser
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