15th Annual LMOP Conference
Hilton Baltimore Hotel
January 18, 2012

LFG to RNG & Utilization of CNG Fuel in Solid Waste Vehicles
DeKalb County Sanitation

- DeKalb County is in Metropolitan Atlanta
- 1937 Sanitation began Collection & Disposal of MSW
- 1977 Seminole Road Landfill was opened
- 785 Activity and 365 Acres Buffer and Soil Borrow
- Collects MSW 159,000 Residents & 8,000 Businesses
- Disposes 400,000 MSW Tons annually
- Density 1,850 lbs per cubic yard – Compost as Cover
- Site Disposal Capacity 2091
Seminole Road Landfill

- 2000 began to Flare Landfill Gas
- Today the site generates 2400 scfm of LFG
- Non-Attainment rating of 25 Tons of NOx
- 2006 developed a Green Energy Facility producing 3.2 MW of electricity and sale to Georgia Power using 1,100 scfm of LFG (1,300 remaining – 2,000 add’l in 2018)
- 2006 began Feasibility Study with Mack Truck and Waste Management Converting LFG to LNG as Fuel
- 2007 Cummins Engine developed CNG for Heavy Duty Vehicles
- 2008 Diesel Fuel exceeded $ 4.00 per gallon
- Natural Gas Prices doubled in price per mmbtu
Sanitation Collection

- Sanitation operates 306 over the road vehicles
- 2008 Sanitation used 1.5 million gallons of Diesel to Collect and Transport MSW
- Waste Collection Vehicles were converting to CNG
- Conversion to CNG from Diesel is expensive and could not justify unless there is a way to keep Natural Gas Prices Stable – LFG to RNG
- Most High Btu Gas from LFG was using a minimum of 2,500 scfm to justify the development
- 2009 New Technologies became available to drastically reduced the LFG volumes needed to develop a High Btu project
High BTU Option Evolves

- 2006 High Btu Facilities were only being developed with large volumes of Landfill Gas (3,000 or higher)
- 2009 High Btu Facilities were being developed with medium volumes of Landfill Gas (1,500 to 2,000)
- 2009 Sanitation began to visit other CNG and High Btu technologies projects in California, Ohio and Pennsylvania using lower volumes of LFG
- Today High Btu Facilities are being developed with lower volumes of Landfill Gas (500 to 1,000)
- 2009 Sanitation applied for ARRA Funding under the Clean Cities Petroleum Reduction Stimulus Grant
DOE – Petroleum Reduction Grant

- DeKalb County / Metropolitan Atlanta Alternative Fuel & Advanced Technology Vehicle Project
  - Issuing Authority – Department of Energy
  - 110 Applications
    - 25 Awards ($300mil)
  - Federal Grant Award
    - $14,983,167
  - Lead Applicant – DeKalb County $ 7,080,000
  - Partners
DeKalb County Project

- Development of Landfill Gas (LFG) to Renewable Natural Gas (RNG) Facility (1,000 scfm = 1.7 mm dge)
- Development of a Compressed Natural Gas (CNG) Public Access Fueling Stations (4 in DeKalb County)
- Utilize existing transmission pipeline to store and designate to CNG or LNG Fueling Stations (Green Tag Attributes – RIN’s)
- Initially Deploy 40 CNG Fuel Sanitation Vehicles
- 39 additional units scheduled for 2012
- Retrofit the service shop to be able to accommodate CNG vehicles
- Marketing and Education of General Public
Natural Gas and RNG Resources

**Natural Gas**

- Fossil Fuel Resources
  - 200+ Years of Domestic Reserves
  - World NG Reserves 3x that of Oil
  - 20% use is for Power Generation

**Renewable Natural Gas**

- Renewable Natural Gas Resources
  - Municipal Solid Waste Landfills
  - 525 potential sites (500+ scfm with 50% methane)
  - Agricultural Waste Centers
  - Dairy Farms – 500 heads
  - Wastewater Treatment Facilities
  - WWT – 5 MMGPD flow

- Seminole Road Landfill
  - 80 Years Disposal Site Life
  - 100+ Years RNG - Methane Resources
DeKalb County Renewable Fuels Facility

- Owned by DeKalb County, GA
- Designed, Engineered, Built and to be Operated by Energy Systems Group
- Facility Operational April 2012
- Building Designed to be LEED (Leadership in Energy and Environmental Design) Certified
- Initial Input of Landfill Gas = 1300 SCFM
- Plant Expandable to Input = 2600 SCFM
- Compressed Natural Gas (CNG) Annual Production = 2,334,755 Diesel Gallon Equivalents (DGE)
- Landfill Gas (400 – 600 BTU/SCF) Processed to Renewable Natural Gas (≥ 950 BTU/SCF)

- Direct Site Emissions Reduced Over the Lifetime of the Facility:
  - Carbon sequestered by 197,266,825 tree seedlings grown for 10 years
  - CO2 emissions from 320,558,600 propane cylinders used for home barbeques
  - CO2 emissions from 865,400,050 gallons of gasoline consumed

<table>
<thead>
<tr>
<th>GASEOUS COMPOUNDS</th>
<th>PRE-PROCESS</th>
<th>POST-PROCESS</th>
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<tr>
<td>Methane</td>
<td>50 – 55%</td>
<td>&gt; 98%</td>
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<tr>
<td>Carbon Dioxide</td>
<td>35 – 40%</td>
<td>&lt; 2%</td>
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<tr>
<td>Total Inert + Oxygen</td>
<td>5.5 – 14%</td>
<td>&lt; 2%</td>
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Construction Progress
Landfill Gas to RNG Transportation Fuel

CO₂ Removal

Utility Flare Seminole Landfill

CNG Fuel Station

Dryer

Compressor

Storage Tanks
Cleaner & Quieter

- With utilizing clean methane as vehicle fuel, the County realizes a major reduction in emissions
- CNG Vehicles are significantly quieter
CNG Vehicles Produce Less Smog and Soot

**NOx Reduction: Less Smog**

- Natural Gas: ≥85%
- NOx Treatment for Diesel Engines: 0-25%
- Diesel Emulsions: 10-15%
- Ethanol Blends: 0-3%
- Oxidations Catalysts for Diesel Engines: 0-3%
- Low Sulfer Diesel: 0-3%
- Biodiesel (B20): -5-0%

**PM Reduction: Less Soot**

- Natural Gas: ≥90% w/Cat
- PM Traps for Diesel Engines: >85%
- Diesel Emulsions: 50-65%
- Biodiesel (B20): 35-40%
- Oxidations Catalysts for Diesel Engines: ~20%
- Low Sulfer Diesel: ~20%
- Ethanol Blends: 15-20%
Summary and Conclusions

- Reduction in Overall Emissions from the Landfill
- Reduction in Vehicle Emissions
- Reduction in Noise from quieter CNG Vehicles
- Reduction in Vehicle Fuel Cost
- Predicable Vehicle Fuel Cost for the Long Term
- Increased Revenue from the Sale of Natural Gas
- Increased Revenue from the Sale of Green Tag Attributes
- Identifying Funding Opportunities to gain support from the BOC and the General Public in a Tight Economy
- Continued efforts to support the County’s goal of being a Green and Sustainable County thru Innovation
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