Turning Gas into Green – Conversion of LFG to Renewable Natural Gas Vehicle Fuel
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Biogas
- Byproduct Created by Anaerobic Processes
  - Biodegradation of Waste in Landfills
  - WWTP Anaerobic Digesters
  - Organic Waste Anaerobic Digesters
- Primarily composed of Methane (CH$_4$) and Carbon Dioxide (CO$_2$)
- Other constituents (Water, Hydrogen Sulfide, etc.)
- CH$_4$ represents significant energy resource

Historical Utilization of Biogas
- Flaring
  - Most common historical use
  - Smaller & Arid Region LFs/Lower volume WWTPs
  - Insufficient CH$_4$ generation for cost-effective electrical production
- On-site heating
- Electrical Generation
  - Larger Landfills/Higher volume WWTPs
  - Higher rates of CH$_4$ generation

Recent Trends
- Electric Production
  - More renewable electric production alternatives in marketplace
  - Changes in tax and policy incentives
  - Reduced revenue rates for electric production from biogas
- Alternative Fuels
  - Historical high price of petroleum→alternatives to diesel/gasoline
  - Air quality mandates
  - Renewable vehicle fuel incentives
  - Fleet conversions from diesel/gasoline to CNG/LNG
Available Technologies

- Pressure Swing Adsorption (Guild)
- Water Scrubbing (Greenlane)
- Membrane Separation (BioCNG)

BioCNG

- Small/Medium/Arid Location landfills with lower landfill gas flows (100-1000 scfm)
- Cornerstone staff developed process/system for removing CO2, water, H2S, siloxanes, and other contaminants from landfill gas
- Pressurized into CNG vehicle fuel

St. Landry Parish Sanitary Landfill

- Type II MSW Permitted 1986
- Acceptance Rate of 350 TPD
- 3 Million Tons Waste in Place
- LFG Collected = 200 - 400 scfm

Project Development

- Systematic Project Development
  - LFG Collection – CO2e Sales
  - BioCNG Vehicle Fuel – Phase 1
  - BioCNG Vehicle Fuel – Phase 2
Landfill Gas Collection System Installation

- Driven by the Voluntary Carbon Market: A window of opportunity to recover capital cost
- GCCS Commissioned January 2009
- Reduction of >150,000 Tons CO2e (2015)
- $800,000 Carbon Credit Sales

Project Development

RNG Vehicle Fuel Phase 1

- Why RNG Vehicle Fuel?
  - Key Factors
    - Biogas Feedstock *
    - Evaluated Options
    - Developing RNG Technology
    - Available funding sources *
    - Fuel Price > $3.00/GGE
    - Access to Vehicles *

Successful BioGas Project Development Triangle

Biogas Source
- WWTP
- Digester
- Landfill

Fuel/Energy Market

Capital
$

Phase I Economics

- Phase 1
  - Developed a fuel demand with projected savings of > $2/Gal
  - District would leverage <$250,000 of local funds for the project
  - State and Federal Grants available for $500,000
  - ROI ($250,000) 3.5 YRS or 10.5 YRS for the entire project
St. Landry Parish

Plant Completion
$750,000
April 2012

Conversions - 22 Vehicles

• 1 Passenger Van
• 5 Sedans
• 16 Fleet Pick Up Trucks

Drivers for Phase II Development

• Flaring excess biogas
• Parish residents proud of BioCNG vehicle fueling and supportive of expansion – Required increased fuel demand
• Began exploring BioCNG fuel sales: school district and others
• Captive fleet - 5 year solid waste hauling contract due up in 2 years
• Develop a win - win strategy (KEY PROJECT TAKEAWAY)

Phase II Development Process

• Initiated discussions with Progressive Waste Solutions: Existing contractor
• Negotiated BioCNG fuel sale:
  • Contract extension – (5 year extension + remaining 2 years)
  • CNG refuse truck purchase – 11 new CNG trucks
  • Minimum guaranteed fuel purchase
  • Uninterruptible CNG fuel supply
• Would triple existing BioCNG demand to ~ 200,000 GGE/year
• Existing BioCNG 50 capacity ~ 75,000 GGE/year
Off-site Fueling Station

- No natural gas backup available at or near the landfill
- Parish committed to developing an off-site BioCNG/CNG fueling station in nearby community
- Potential future public access to BioCNG
- Provide the required uninterruptible CNG fuel supply
- How to accomplish?

St. Landry Parish – August 2015

- BioCNG Expansion initiated in January, 2015
- Waste hauling trucks fueling from Phase 1 BioCNG system and satellite station for 2 months, beginning August 2015

Phase II Fueling Configuration

- Expand Existing BioCNG LFG conditioning system
- Develop a natural gas “Satellite” CNG fueling station
- Provide tube trailer filling at “Base” – decant at “Satellite”
- Developed the first Base/Satellite RNG facility to use high pressure tube trailers for off-site RNG fueling

BioCNG System Upgrade
Persigo WWTP

- Grand Junction, Colorado
- Small-Medium WWTP (8.2 MGD)
- Two anaerobic sludge digesters (120,000 cf/day)
- Digester Gas used for process heating
- Remainder of Digester Gas flared

Grand Junction CNG Fueling Station

- Existing Fueling Facility
  - 6 miles from WWTP
- Pipeline Gas from Xcel Energy
- Public Agency Fueling
  - Grand Valley Transportation bus fleet
  - Municipal Solid Waste Collection fleet
  - Other public agency vehicles
- CNG Fueling Facility Open to public
  - Located between Salt Lake City & Denver
  - Recreational vehicle use

BASE / SATELLITE SYSTEM Economics

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*Planned
**Persigo BioCNG Project**

- Install BioCNG 100 Unit at Persigo WWTP
- Decommission Existing Flare (old & needing upgrade)
- Convert existing boilers to optionally operate off CNG from BioCNG unit
- Pipeline to Grand Junction CNG Fueling Facility

**Improvements at WWTP**

- BioCNG Unit
  - BioCNG 100
  - Skid Mounted Unit in Winterized Enclosure
  - Sulfa Treat for H₂S Removal
  - Utility Flare for Waste Gas (permitted with CDPHE)
- Design to accommodate future expansion
- Connection to existing boilers in digester building
  - Available but not currently used (more economical as vehicle fuel)
  - System controls interconnect with existing controls
- Removal of outdated existing flare (permitted with CDPHE)

**Off-site Improvements - Pipeline**

- 6 mile pipeline from WWTP to fueling facility
  - Low pressure (typical operation ~20 psig, max allowable<100 psig)
  - 4-inch High Density Polyethylene (HDPE) SDR-11
  - Installed in public road right-of-way and public walking/bike path right-of-way
- Multiple crossings needed to be dealt with:
  - Ephemeral/intermittent streams
  - Interstate 70
  - Railroad Spur
  - Wetland areas
  - Roads
Off-site Improvements – Pipeline (cont.)

• Installed by multiple methods
  • Open cut trench
  • Plow
  • Directional drilling

• Permits/approval from multiple agencies
  • Union Pacific Railroad (UPRR)
  • Colorado Department of Transportation (CDOT)
  • US Army Corps of Engineers (no open cut in jurisdictional waters)
  • City of Grand Junction

Off-site Improvements – Fueling Facility

• Located in existing CoGJ maintenance yard

• New pressure regulator at interconnect to line from Xcel Energy Meter

• Operational strategy – Integrate with the existing compressor controls to preferentially use biogas if available
  • Pipeline gas available for “automatic” backup
  • Utilize storage capacity of 6 mile pipeline to address fluctuations in fueling demand
Off-site Improvements – Fueling Facility (cont.)

Biogas to BioCNG benefits

• Beneficial use of previously “wasted” resource
  • Eliminate flaring of equivalent of approximately 146,000 gallons of gasoline per year
• Financially viable at low flow rates
  • $2.8MM capital cost (43% for pipeline & fueling facility improvements)
  • Estimated 9 year payback period
• Lower effective costs compared with diesel/gasoline
• Prevent release of approximately 3 million pounds of carbon dioxide to the atmosphere annually

Questions???

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