

# Landfill Biogas to CNG – The Future is Now



LMOP 2013 Annual Conference  
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# LFG Energy – A Brief Look Back

- Primary biogas uses - electricity, direct use
  - Limited pipeline, vehicle fuel, etc.
  - Driven heavily by Section 29, 45 and 1603
  - Higher NG prices allowed growth of medium-Btu
- Incredible success story – U.S. is the world leader!



However, maybe time for a  
course correction...

Cheap  
and  
abundan  
t natural  
gas

Rising  
petroleum  
prices

Increased  
focus on  
climate and  
GHG

# The CNG Revolution has begun!



- CNG (compressed natural gas)
- 15,000,000 NGVs running worldwide
- Fleets (especially refuse) are converting to CNG for cost savings and environmental sustainability.
  - Vehicle emissions contribute to air pollution, climate change, and health concerns.
- Citizens want energy security and independence.
- Vast majority of CNG to date has come from fossil sources.

A new opportunity is  
before us – biogas to  
CNG!



# Why Biogas-CNG?

- “...renewable natural gas and fossil gas are the only vehicle fuels that can displace significant amounts of oil while safeguarding U.S. national security and strengthening the economy.”
- “The U.S. economy is sapped of almost \$845 million a day that is sent abroad to buy 45% of the oil to meet our needs. Some \$110 million of this goes daily for the oil needed in diesel production.”
  - Fluctuating price destabilizes U.S. economy and upsets local community budgets
- “The 10 million trucks and buses on U.S. roadways provide essential services to every American community, and they transport goods worth nearly 70% of the GDP.”
  - Buses and trucks make up just 4% of all vehicles, but they use 23% of all highway fuel – almost entirely high-carbon diesel from foreign oil.

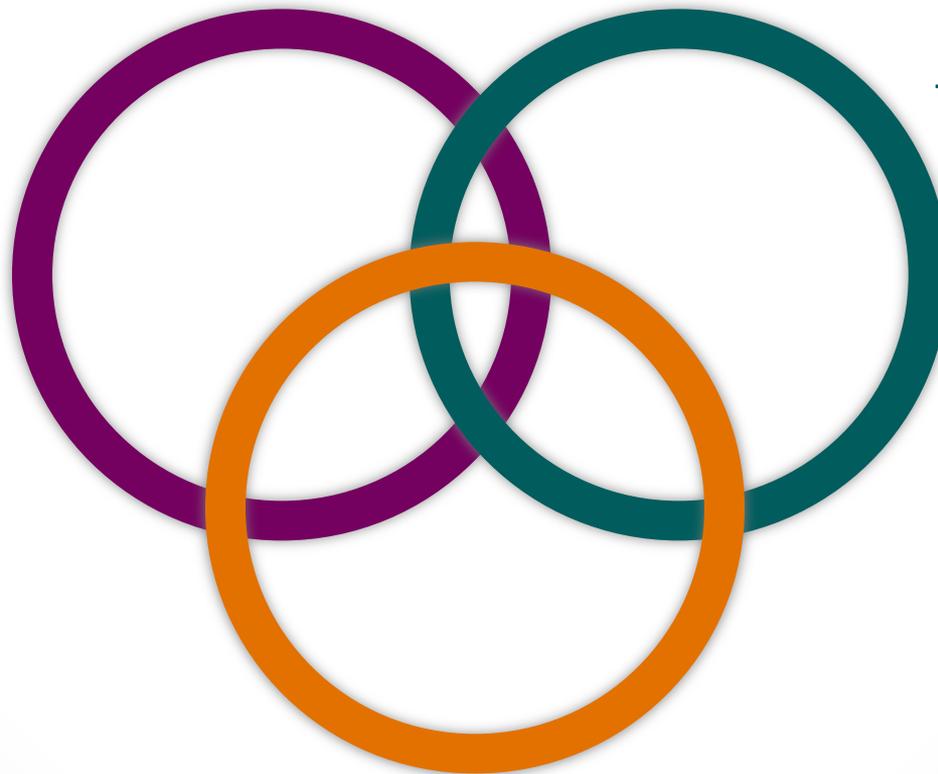
*Renewable Natural Gas (RNG) - The Solution to a Major Transportation Challenge A Clean, Secure, Commercially Viable Replacement for Diesel Fuel Today” (Energy Vision, 2012)*

# Biogas-CNG Benefits

- Significant **savings** over gasoline and diesel
  - 50-75% savings over current gas/diesel cost
  - Cost-competitive to fossil-based CNG
- Local, **green**, renewable fuel source
  - Up to 90% GHG reductions v. gas and diesel
  - Renewable fuel and GHG credits
- **Control** your future!
  - Cost locked in for 15-20 years
  - Hedge against rising NG prices

# Successful Projects

**Biogas  
Source**

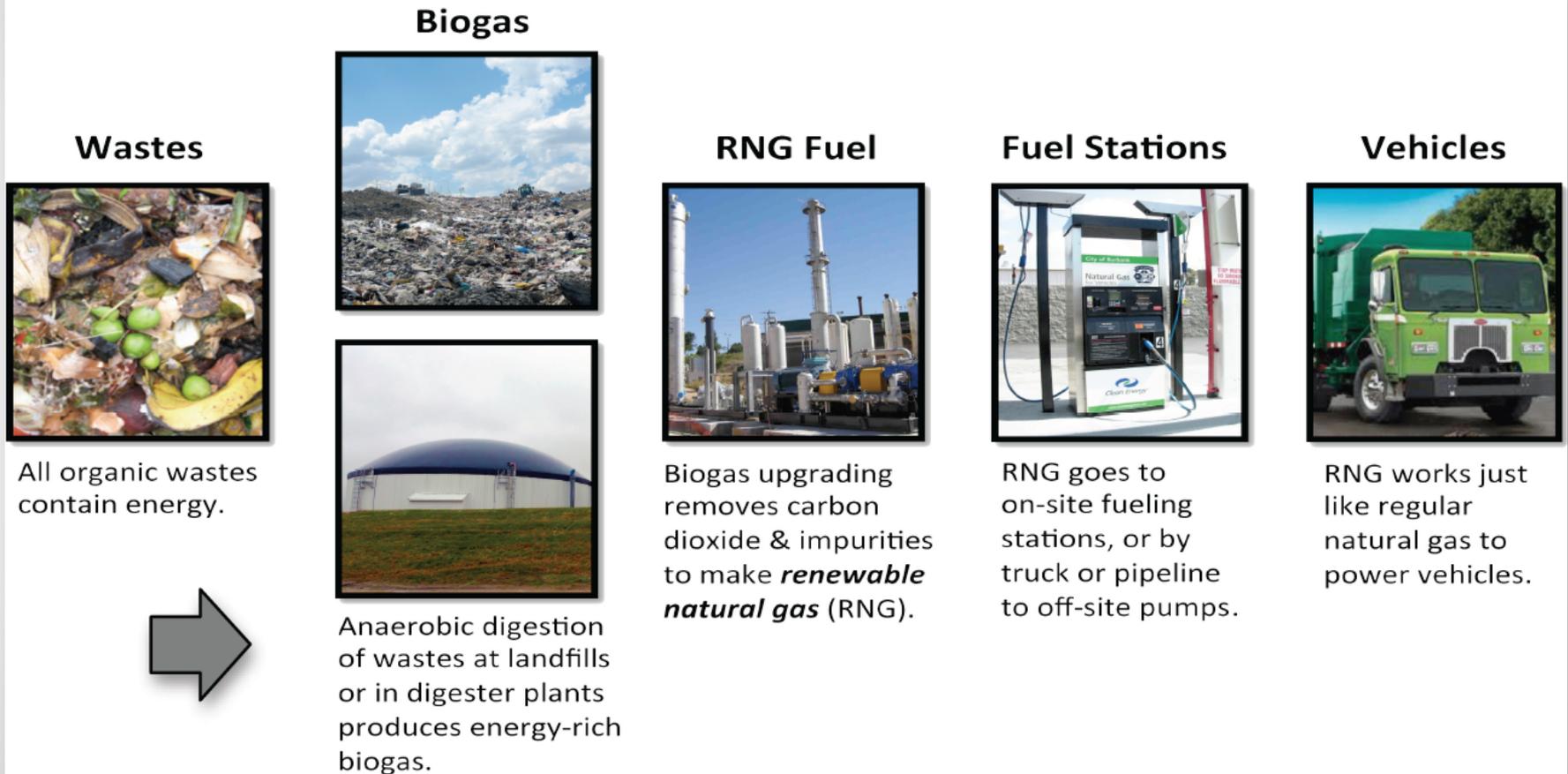


**Vehicle Fuel  
Demand**

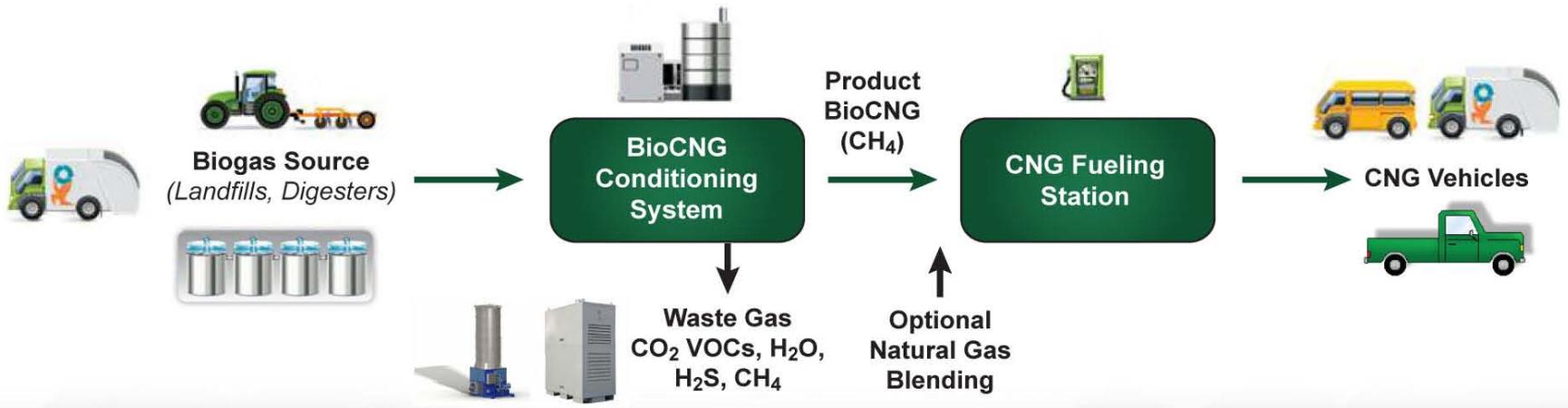
**Project Enabler/  
Developer**

# The Biogas Resource

(Energy Vision 2012)



**Figure 2. The Pathway from Organic Waste to RNG**



# Best Vehicles for 'CNG – ROI'

- High fuel use vehicles with return-to-base operations or repetitive route or pre-set geographic operating areas.
  - Regional freight truck – 16-20K GGE
  - Transit buses – 12.5-15K GGE
  - Refuse trucks – 7.5-10K GGE
  - Municipal sweeper – 5-6K GGE
  - Airport shuttle service – 5.5-7.5K GGE
  - Taxi - 4.5-5.5K GGE
  - School Bus – 2-3K GGE

# NGV Options



# Current Biogas to RNG Projects

## Renewable Natural Gas (RNG)

### 8 Projects in the US

<u>Waste site</u>	<u>Location</u>	<u>Vehicles fueled with RNG</u>
Altamont Landfill	CA	300-400 refuse trucks
Fair Oaks Dairy	IN	42 milk delivery trucks
Rodefild Landfill	WI	25-30 vehicles
Sauk Trail Hills Landfill	MI	NA (RNG leaves site via pipeline)
Columbus bio-Energy Digester	OH	25+ vehicles
Janesville Wastewater Plant	WI	40+ vehicles by 2022
St. Landry Parish Landfill	LA	15+ vehicles
Rumpke Landfill	OH	10-15 refuse trucks

*Energy Vision, 2012*

# Operating Projects



First vehicle fueled — March 18, 2011

# Biogas-CNG System Economics

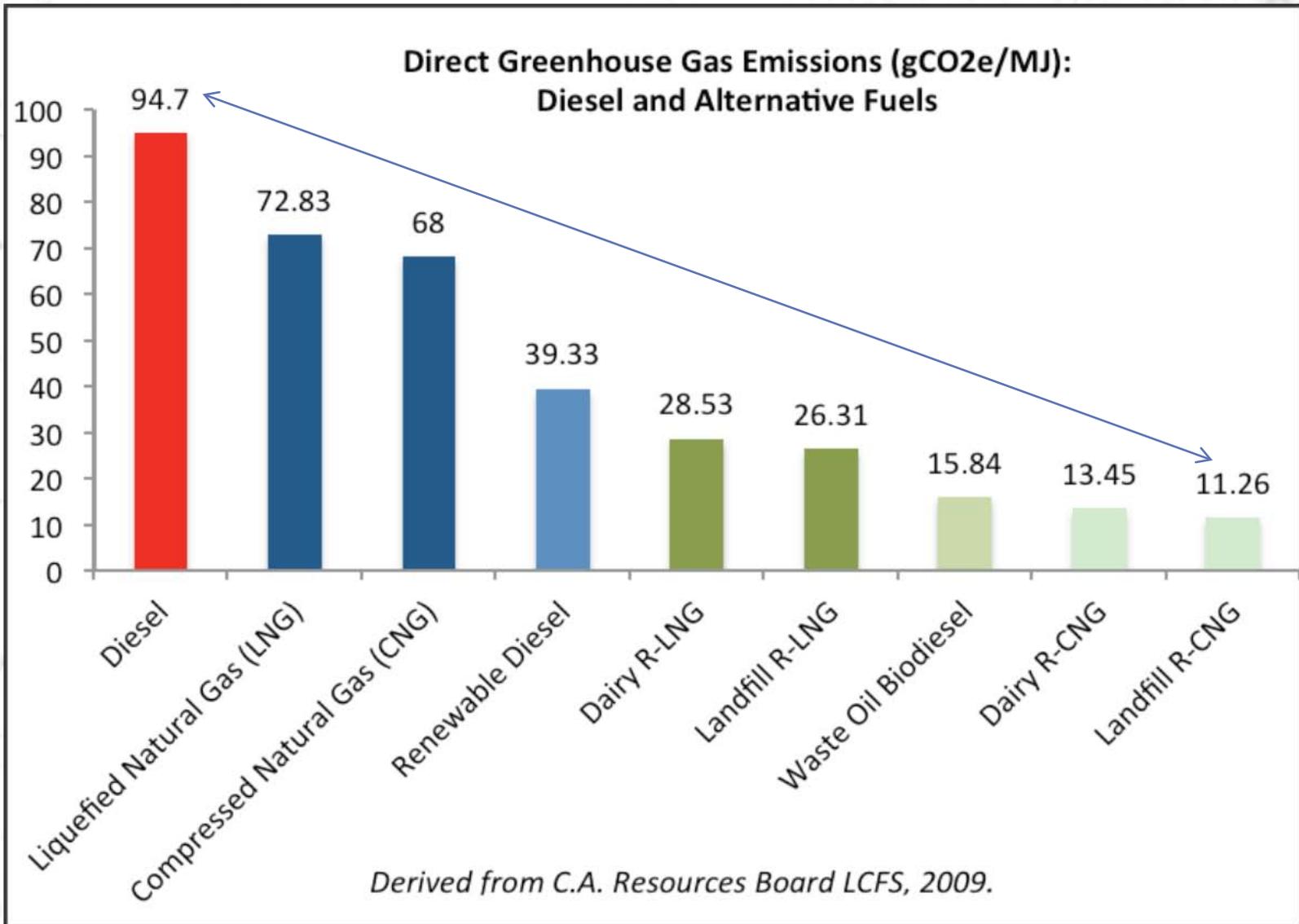
- Economies of scale will play role
- Biogas quality affects output and O&M
- Fuel demand is critical
- Produce CNG at **\$0.75-1.50 per DGE** (w/RINs)
- Vehicle conversions
  - New HDVs – 10-20% higher (coming down)
  - Retrofits - passenger vehicles/light duty ~\$9-15K
- With diesel at \$4+ gallon...

**payback expected at between 1 and 5 years**

# Biogas-CNG 200: Sample Project

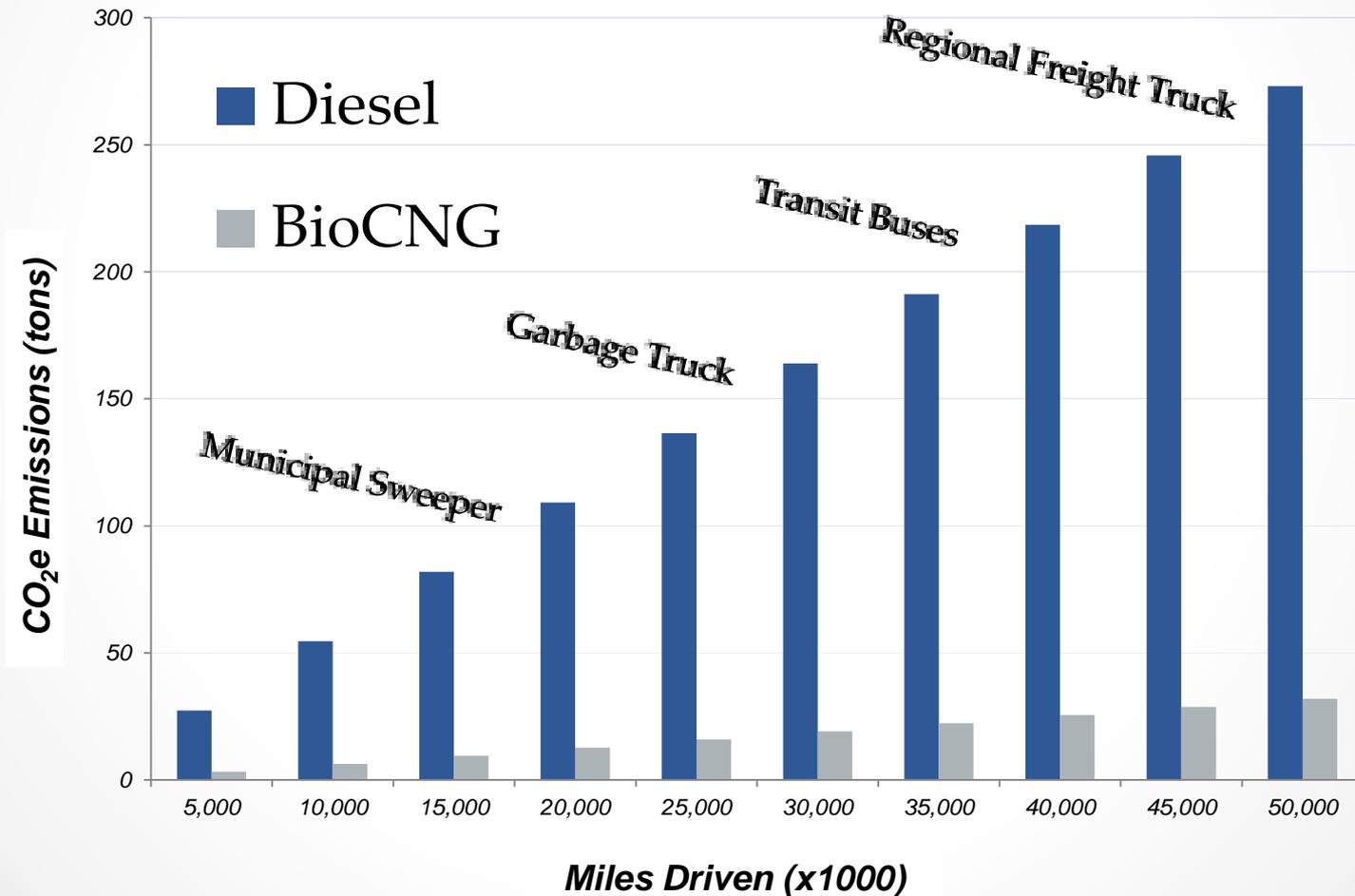
- Biogas Input - 200 cfm of landfill gas (54% methane)
  - Assumes 'typical' ranges for moisture, siloxanes, VOCs, H<sub>2</sub>S, and less than 5% N
- Fuel Production
  - 240,000 Diesel Gallon Equivalents (DGEs) per year
  - 775 DGEs/day - enough fuel for 15-20 trash trucks (or 40-50 light duty vehicles)
- Fuel Savings
  - Assuming savings of \$2 gallon on diesel costs
  - \$480,000 in annual fuel savings
- With Renewable Fuel Credits (RINs)
  - \$170,000 per year (assuming \$0.72 per DGE)

# Environmental Benefit



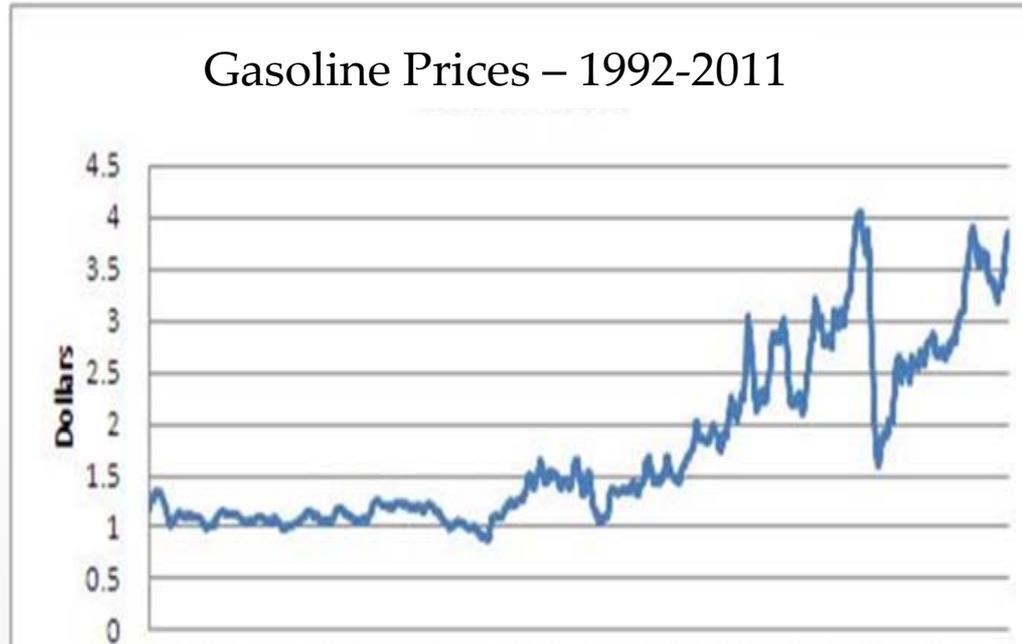
# Bio-CNG v. Diesel Emission Reductions

10 garbage trucks converted from diesel to Bio-CNG –  
reduce 1,000+ tons CO<sub>2</sub>e annually



# Local Control of Fuel Cost

- If you could go back 20 years and lock down your fuel costs, wouldn't you?
  - 1992 - \$1.25 gallon gasoline
  - August 2012 - \$3.73 gallon gasoline
- Why not control the next 20!



BioCNG	<b>1.01</b>	$\frac{9}{10}$
CNG	<b>2.21</b>	$\frac{9}{10}$
DIESEL	<b>4.19</b>	$\frac{9}{10}$

# Biogas-CNG Lessons Learned

- Trucks are quieter and cleaner – great customer service
- Smaller, modular systems allow for growth as:
  - Biogas increases; capital becomes available; fuel demand rises
- Fuel complies with CNG engine warranties
- Bio-CNG vehicle performance comparable to gasoline/diesel
- Biogas quality
  - Higher methane – more fuel
  - Biogas contaminants impact on operating costs - not fuel quality

# Biogas-CNG Summary

- Proven technology
- Low cost fuel
- Long-term fixed cost
- Lowest carbon footprint





# BioCNG<sup>TM</sup>

*Vehicle fuel for a green future*

[www.biocng.us](http://www.biocng.us)

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