

Utilizing Biogas to Power Vehicles

The Power of Renewable Natural Gas



BioCNGTM

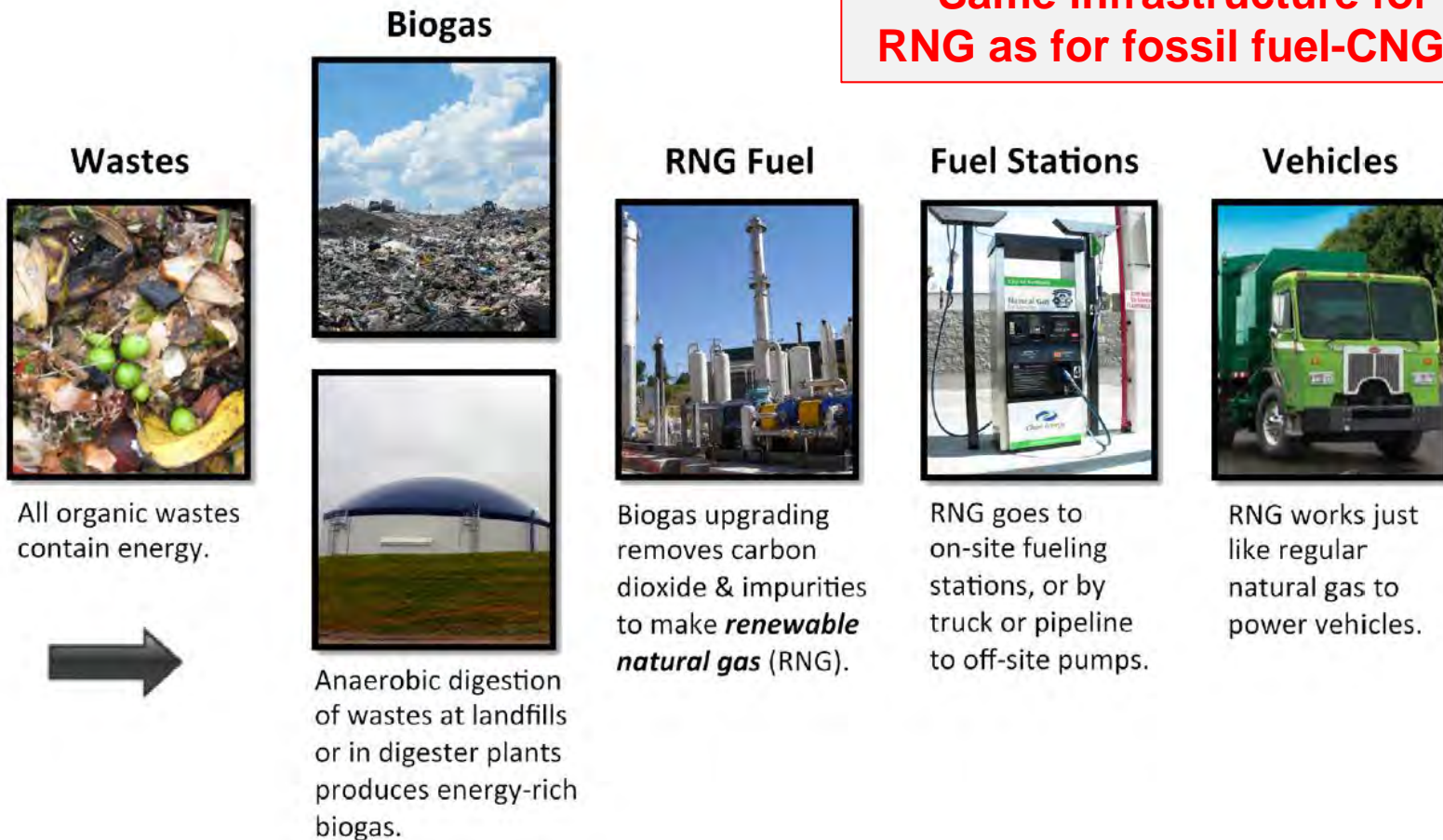
Vehicle fuel for a green future

October 2, 2014

Renewable Natural Gas-Biomethane

The Pathway from Organic Wastes to Renewable Natural Gas (RNG) Vehicle Fuel

**** Same infrastructure for RNG as for fossil fuel-CNG**



Potential Fuel Sources

Operational Biogas Systems in the U.S. - Agricultural, Landfill, and Wastewater Systems Only



www.americanbiogascouncil.org/biogas_maps.org

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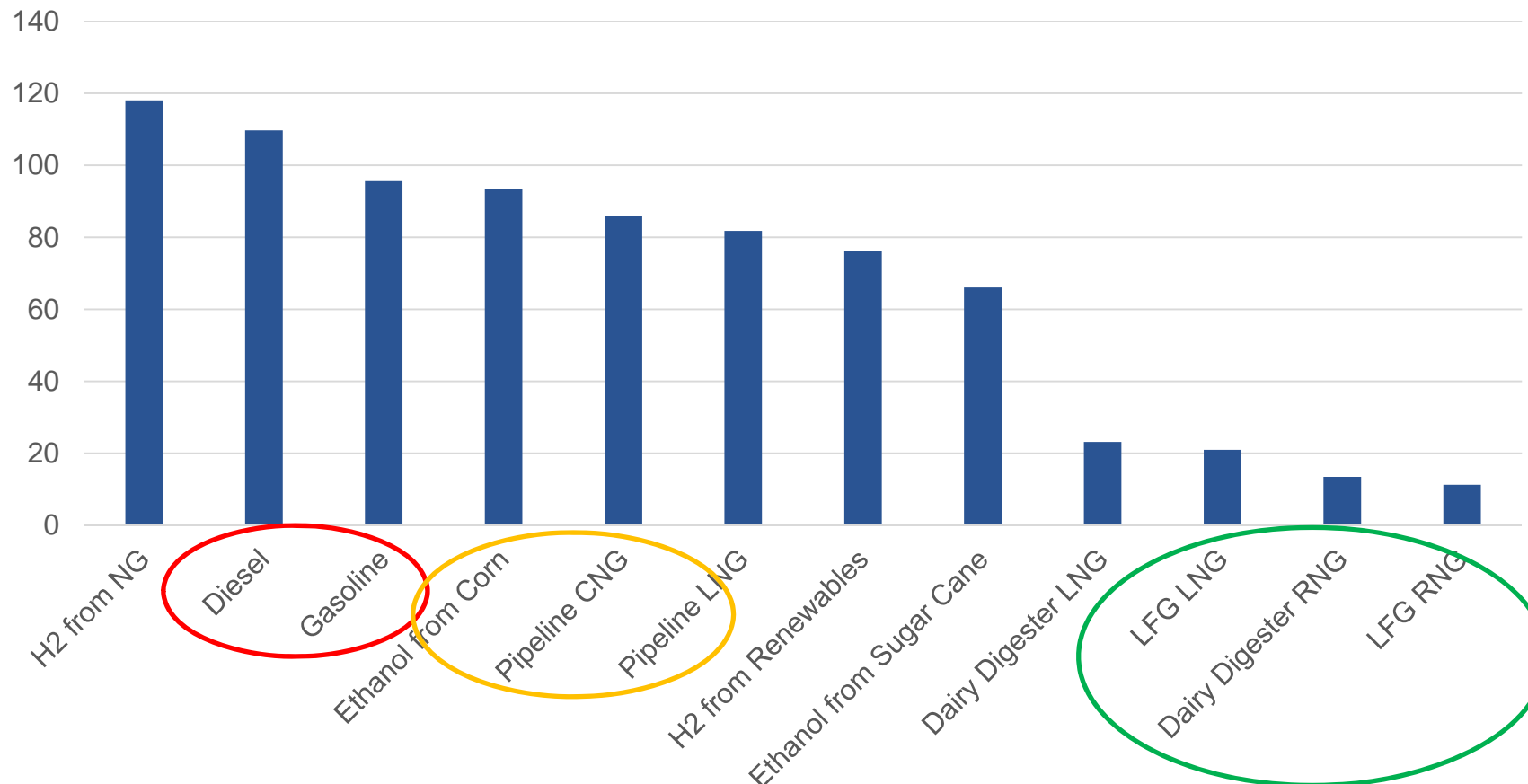


How Much Raw Material Do I Need?

- LFG @ 50% methane
 - 100 scfm – 400 gge/day or 350 dge/day
- Digester Gas @ 60% methane
 - 100 scfm – 500 gge/day or 440 dge/day
- 2-3 tons of food scraps – 55 gge or 50 dge

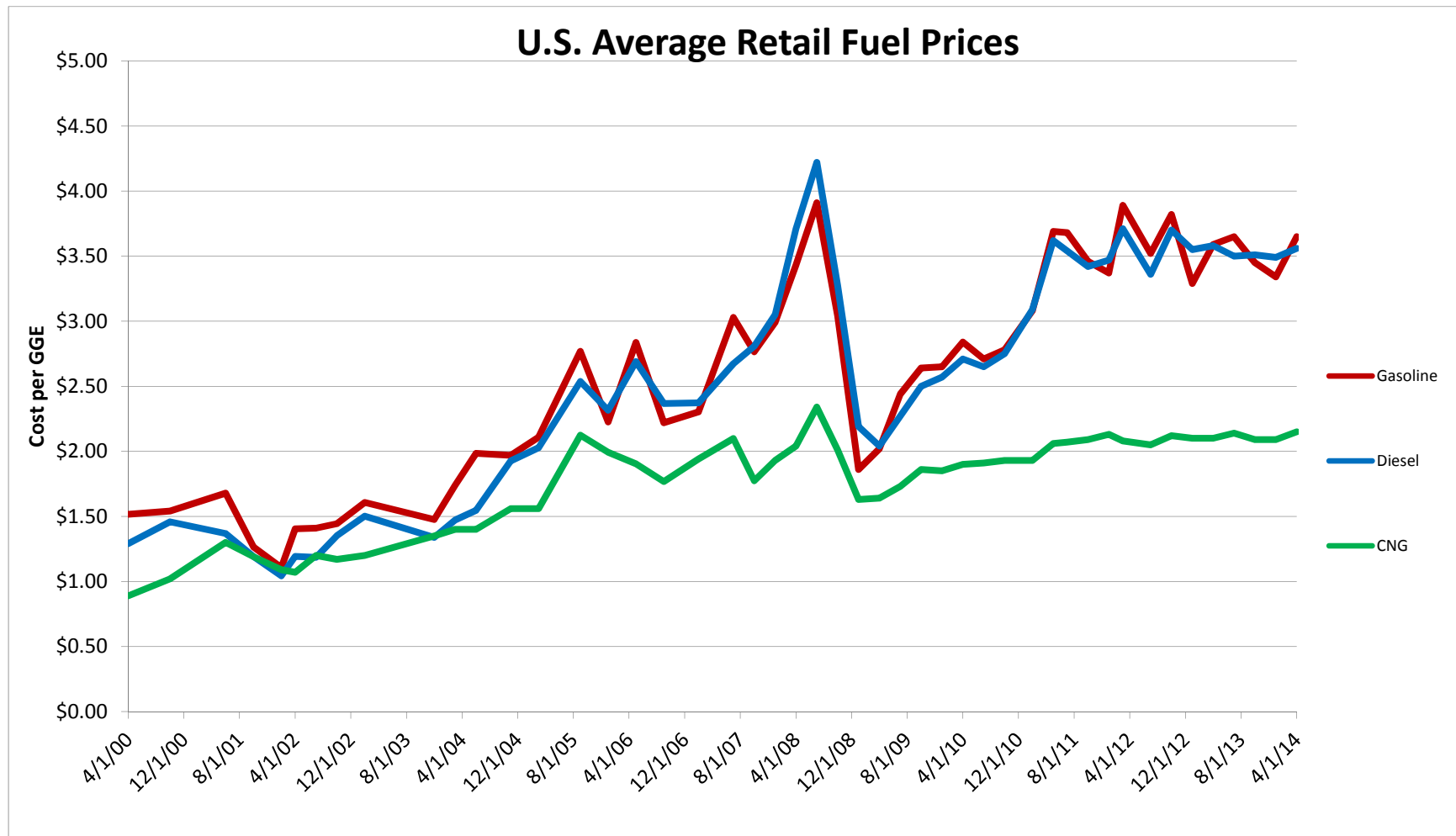
Emissions Potential (approximate)

Carbon Intensity Value (gCO₂e/MJ)

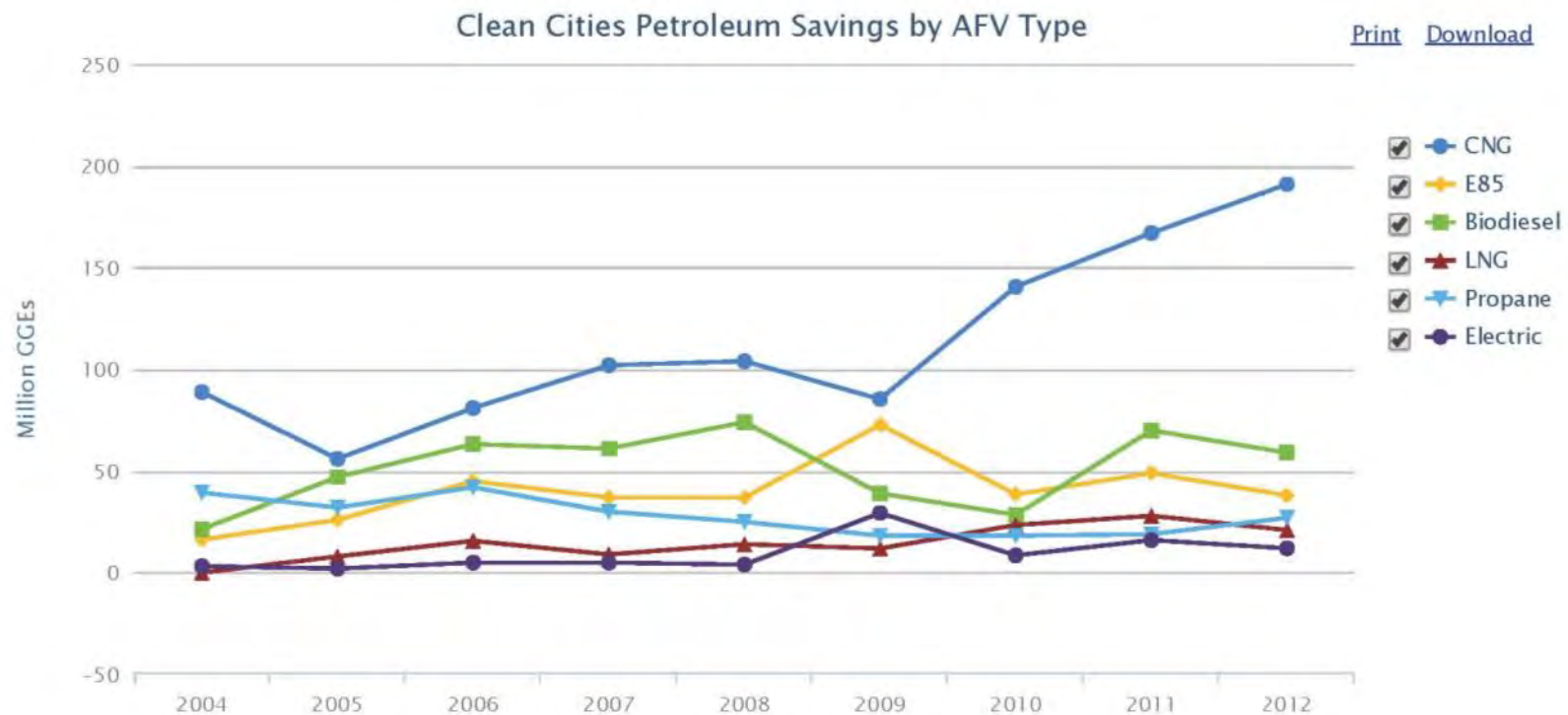


CARB Low Carbon Fuel Standards, Table 6

Relative Cost



Alternative Fuel Trends



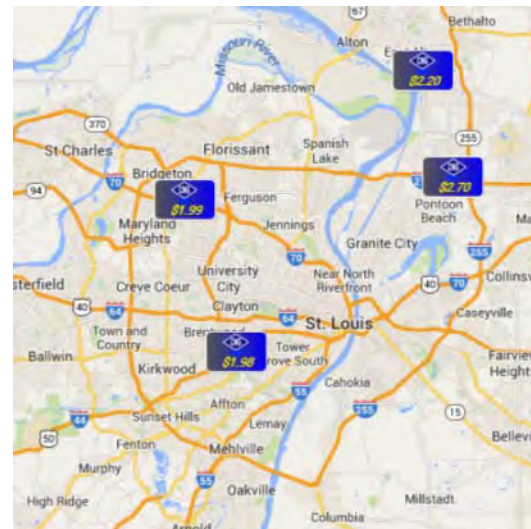
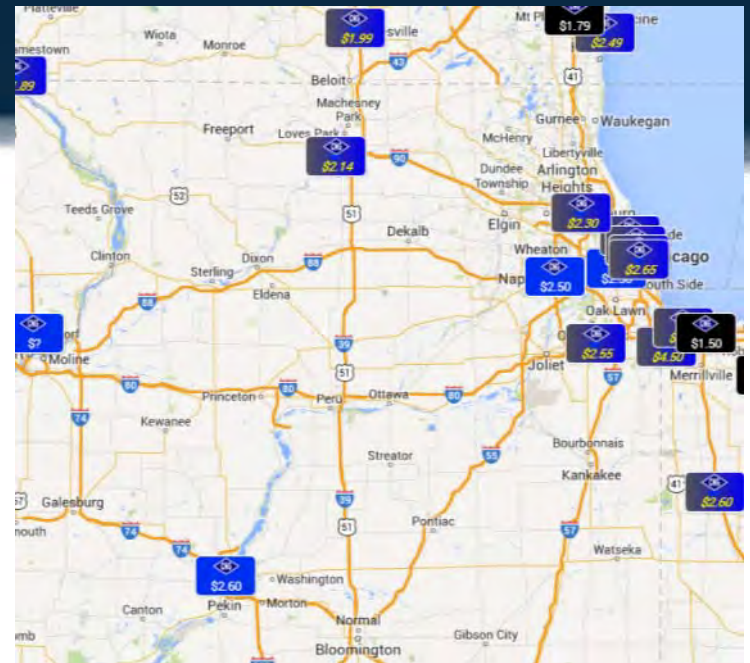
CNG Fueling - Perspective

- More than 15 million NGVs worldwide
- 140,000 NGVs in United States
- 1,200 NGV fueling stations (282 – CA)
- 50% of these are publically accessible
- 97% of Transportation Sector relies on gasoline and diesel
- Private fleet conversion
 - Long-haul trucking and refuse collection
 - AT&T
 - UPS
 - Ozinga
- Municipality conversions
 - 85% of new refuse collection vehicles
 - 25% of new transit busses

American Gas Association - 2014

CNG Fueling in Illinois

- 26 existing CNG (2011)
 - 8 – Public
 - 18 – Private
- 39 existing CNG station (2014)
 - 10 – Public
 - 29 – Private
- 5 proposed stations



Ref: AltFuelPrices.com
& chicagocleancities.org

Tools for Evaluating CNG Use

- US DOE - www.afdc.energy.gov/tools
 - Freightliner - <http://www.freightlinergreen.com/calculator>
 - Love's - <http://www.loves.com/HomeLinks/CNGCustomers/CNGPaybackCalculator.aspx>
- Payback for the example fleet, averaging 125,000 miles per year per vehicle, is a little over two years
 - Fuel savings of ~ \$1.3 million annually



Why don't we have more RNG vehicle fuel projects?

- Renewable Identification Numbers (RINs)
 - Means to track, register and monetize environmental attributes of alternative vehicle fuels
 - Direct payment - not a tax credit - available through 2022
 - The Advanced Biofuel (D-5) RIN is currently trading at \$0.75/DGE
- Vehicle conversion costs: \$10k - \$15k each
- Production Tax Credits (PTC) available for electrical generation, but not for direct-use projects
- Effective excise tax of \$0.41/DGE for LNG vs \$0.243 for diesel

US natural gas production hits record high in August

September 10, 2014

- Natural gas production in the United States increased in August for the eighth consecutive month
- Highest monthly average on record and 3.9 Bcf/d, or 6%, higher than the average in August 2013
- United States continues to break natural gas production records "almost on a daily basis."



State of Illinois Incentives ?

Fuel-Efficient Vehicle Acquisition Goals

To help achieve the statewide goal of reducing petroleum use by 20% by July 1, 2012, as compared to 2008 petroleum use, Illinois state agencies must work towards meeting the following goals:

- By July 1, 2015, at least 20% of new passenger vehicles purchased must be hybrid electric vehicles (HEVs) and 5% must be battery electric vehicles (EVs); and
- By July 1, 2025, at least 60% of new passenger vehicles purchased must be HEVs and 15% must be EVs.

Agencies that operate medium- and heavy-duty vehicles must implement strategies to reduce fuel consumption through diesel emission control devices, HEV and EVs technologies, alternative fuel use, and fuel-efficient technologies. Agencies must also implement strategies to promote the use of biofuels in state vehicles; reduce the environmental impacts of employee travel; and encourage employees to adopt alternative travel methods, such as carpooling.

(Reference [Executive Order](#) 11, 2009)

Illinois Alternate Fuels Rebate Program

- Rebate for 80%, up to \$4,000, of the incremental cost of purchasing an AFV;
- Rebate for 80%, up to \$4,000, of the cost of converting a conventional vehicle to an AFV using a federally certified conversion; and
- The incremental cost of purchasing alternative fuels.
- Eligible fuels for the program include E85, fuel blends containing at least 20% biodiesel (B20), **natural gas**, propane, electricity, and hydrogen.

Illinois Success Stories – Chicago Clean Cities

- Foodliner
 - 2010 - Committed more than \$550k for six new Class 8 Freightliner (Cummins-Westport 9L engine)
 - \$100k Chicago Clean Cities grant & \$175k Federal tax credits
 - Re-fuel at GTI station (Des Plaines)
- Ozinga
 - 2011 – Converted 14 vehicles - grant from Chicago Clean Cities
 - Currently more than 110 mix trucks and 25 support vehicles
 - Plans to convert entire fleet by 2020 – more than 500 vehicles
 - Own/operate two public stations (Pilsen & Mokena)
- Chicago Taxis
 - 2011 - City of Chicago Department of Business Affairs and Consumer Protection (BACP) implemented the Green Taxi Incremental Cost Allowance Program (Green Taxi Program) through Chicago Clean Cities
 - \$1 million in grants - 49 new hybrids and 71 new CNG vehicles



Where are RNG-vehicle fuel projects being developed?

- Electric projects that are sunsetting
- Add-ons to existing electric or direct use projects
- “Small” gas producers
- Geographic Incentives
 - Florida
 - Washington
 - Oregon
 - California
 - Waste Management – Altamont LNG (2009)
 - Anaerobic Food Waste Digesters - CNG



Existing RNG – Vehicle Fuel Projects

Site	State	Details
Dane County Landfill	WI	25-30 solid waste and parks fleet
Janesville Wastewater Plant	WI	40+ vehicles by 2022
City of Riverview Landfill	MI	Growing local municipal fleets
Sacramento Biodigester	CA	40+ recycling vehicles
St. Landry Parish Landfill	LA	15+ vehicles - Sheriff's Fleet
Blue Line Biogenic CNG Facility	CA	Under construct. – startup Oct/Nov
DeKalb County Landfill	GA	Pipeline injection & on-site fueling
Altamont Landfill	CA	300-400 refuse trucks
Columbus Bio-Energy Digester	OH	25+ vehicles
Fair Oaks Dairy	IN	42 milk-delivery semis
McCommas Bluff Landfill	TX	RNG via pipeline
Rumpke Landfill	OH	10-15 refuse trucks
Sauk Trails Hill Landfill	MI	RNG via pipeline

Clean World Sacramento Biodigester and Atlas Disposal



- 100 cfm digester biogas = 500 DGEs/day; added 200 cfm unit for 1,500 DGEs/day
- Generates electricity with excess fuel

- 2013 International Bioenergy Project of the Year
- 2013 Energy Vision Leadership Award



South San Francisco Renewable CNG

September 30, 2014 in [Biofuels](#), [Biomethane](#), [CNG](#), [Fleet Order](#), [Infrastructure](#), [NGVs](#) by [Rich Piellisch](#) | [No Comments](#)

First-Ever Transportation Fuel from Dry Anaerobic Digestion in the U.S., South San Francisco Scavenger Taps Zero Waste Energy & Clean Energy

California's South San Francisco Scavenger is putting in a new fueling station to support its growing fleet of compressed natural gas trucks with fuel derived from local food waste. The compost-based facility will be the first in the U.S. to employ dry anaerobic digestion technology to make transportation fuel, the company says.

South San Francisco Scavenger expects to get 500 diesel gallon equivalents of CNG per day from a new dry anaerobic digestion unit, and will use it to fuel a current fleet of 17 CNG refuse trucks.



This One's from Ryder

September 26, 2014 in [CNG](#), [Conference/Meeting](#), [LNG](#), [NGVs](#) by [Rich Piellisch](#) | [No Comments](#)

Ryder to Sponsor 77th Annual National Beer Wholesalers Convention Business Development Boss Rueben Stokes to Discuss Natural Gas Fleets



Ryder System is spreading the word that it will serve as a Diamond Anniversary sponsor of the 77th Annual National Beer Wholesalers Association convention being held **September 28-October 1** in New Orleans. “One example of how Ryder supports customers is with the adoption of natural gas fleets,” the company said.

Ryder has more than 27 million miles of natural gas operating experience, having deployed more than 600 compressed natural gas and LNG/liquefied natural gas trucks with fleets in California, New York, Michigan, Texas, Arizona, Utah, Georgia and Louisiana.

In Ryder’s biggest NGV deployment to date, customer Anheuser-Busch announced just this month that it would convert its entire Houston fleet – a first for the brewer – to CNG using trucks from Ryder.

What does it all mean - CNG?

- CNG is a growing part of the national vehicle-fuel portfolio
- CNG is relatively inexpensive, has a low rate of emissions and can be utilized within the existing infrastructure
- High, domestic production of CNG should keep prices relatively static, encouraging additional fleet conversions and technological innovations
- Should increase the overall demand for CNG and reduce vehicle conversion costs
- User market keeps growing!

What does it all mean - RNG?

- RNG possesses all of the noted attributes of CNG, but requires processing to remove CO₂ and other contaminants
- There are few historical incentives to RNG production, especially compared to electrical generation
- There is significant untapped potential
 - Landfills
 - WWTPs
 - Ag waste digesters

Why should we use RNG?

- Substantially lower rates of emissions compared to traditional vehicle fuels
- Additional revenue source for farmers, WWTP and landfills
- Increased energy security
- Domestic job creation
 - Unison Solutions – Dubuque, IA
 - ANGI – Janesville, WI
 - Cummins-Westport – Columbus, IN



Operational Locations

Office Locations

- Bolingbrook, IL
- Cincinnati, OH
- Colbert, WA
- Exton, PA
- East Brunswick, NJ
- Farmington Hills, MI
- Ft. Lauderdale, FL
- Grand Rapids, MI
- Greenwich, NY
- Jacksonville, FL
- Kansas City, KS
- Lexington, KY
- Logan, OH
- Madison, WI
- Middletown, NY
- Oceanside, CA
- Phoenix, AZ
- Pittsburgh, PA
- Plymouth, WI
- Portland, OR
- Reading, MA
- Rochester, NY
- Springfield, IL
- St. Louis, MO
- Tucson, AZ
- ★ Middletown, NY

