

ALTERNATIVE FUELS 101: HOW TO CHOOSE THE RIGHT FUELS AND TECHNOLOGY FOR YOUR FLEET

John W. Walton, Chicago Area Clean
Cities, Advance Fueling Consultants

Adam Goldstein, Stag USA

Chris Schmale, Renewable Energy
Group

Samantha Bingham, Chicago Area
Clean Cities, City of Chicago



John W. Walton,
Chair, Chicago Area Clean Cities,
Advance Fueling Consultants
Cell: 630-240-8858
Email: jwalton@advancefueling.com



WHAT ARE ALTERNATIVE FUELS AND TECHNOLOGIES?

Alternative Fuels and technologies are becoming the new normal!
Commonly used today include the following:

- Electric
- Hybrid (gas/Diesel electric and hydraulic)
- Ethanol (various blends from E-10 to E-85 commonly)
- Biodiesel (various blends with diesel (from B2 to B20 typically))
- Natural Gas, Compressed (CNG) and Liquified (LNG)
- Propane (LPL, Autogas)
- Variations of some of the above Bi-Fuel and Dual Fuel
- Anti-Idling Technologies
- Exhaust Retrofits



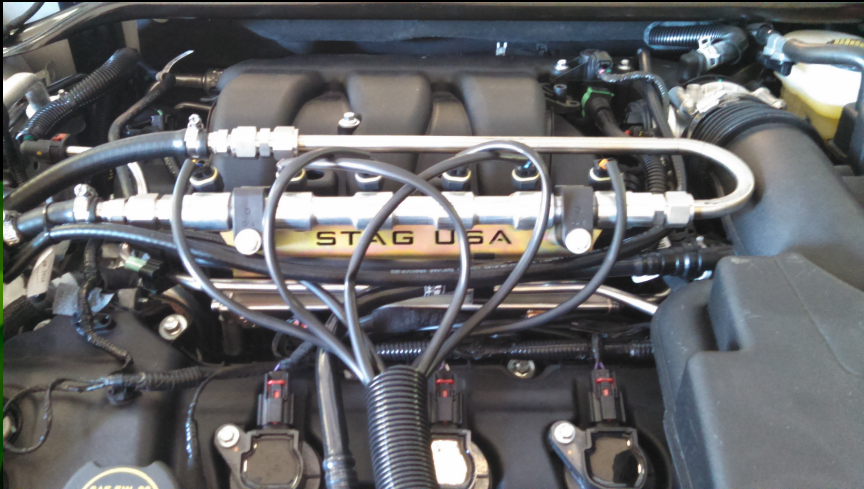
IF YOU HAVE BEEN INVOLVED WITH ALTERNATIVE FUELS AND TECHNOLOGIES PREVIOUSLY, NOTE THE FORMULAS TO COMPUTE THE REAL COSTS HAVE NOT CHANGED, OVER TIME THE COST OF THE TECHNOLOGY AND FUELS HAVE CHANGED DRAMATICALLY.



WHAT FUELS AND TECHNOLOGIES TO USE TODAY AND INTO THE FUTURE

In 2018 there are more choices than in years past.

CNG, LPG, Biodiesel, Ethanol, Hybrid (electric and hydraulic), electric, hydrogen, upcoming fuels as well as new technologies



FUEL SAVINGS THINGS TO DO

- Electrically operated heating and cooling with the engine off
- Devices that limit acceleration
- Driver training
- Add on generators (larger vehicles)
- Limit unnecessary weight
- Perform maintenance, keep tires inflated



CNG, LPG, BIODIESEL, ETHANOL AND HYBRID ELECTRIC

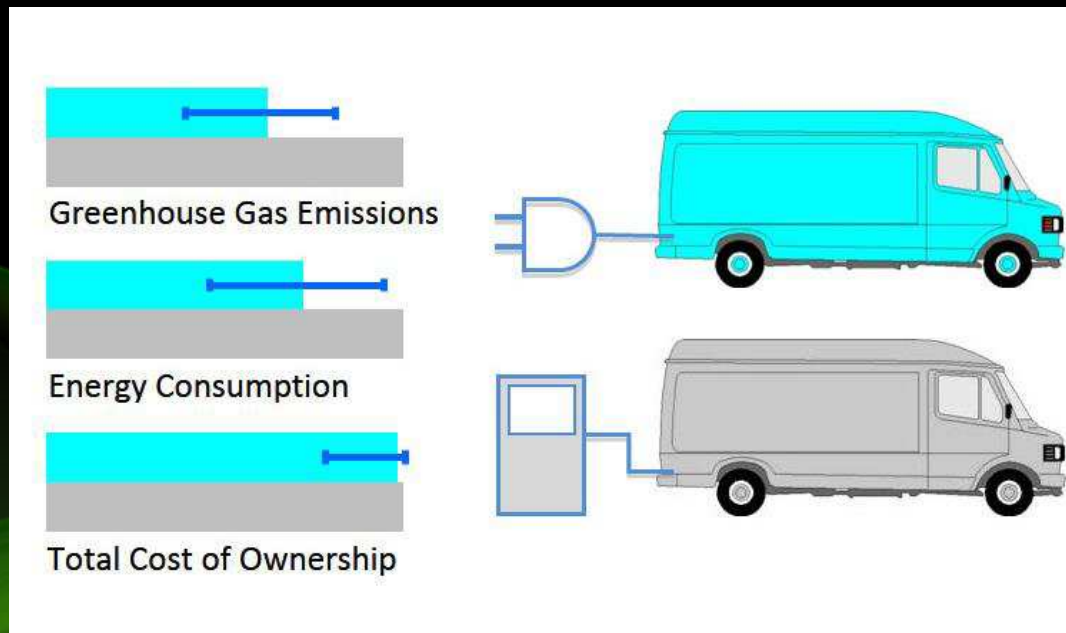
When we converted the fleet I managed we used many different types of fuels and technologies for all of the different kinds of vehicles the fleet had.

The choices were based on the ROI on specific vehicles. We received government grants and rebates to make it all work



BEING GREEN

In addition to the cost of the fuels there is also the “Green Factor” and how that fits into the company or agency culture, in addition there can be great PR value



HOW TO DECIDE WHAT TO USE

You should calculate the TRUE cost, use formulas taking into account all of the following: cost of the fuel, cost of the infrastructure, cost of infrastructure operation (electricity, maintenance and estimated repairs), cost of labor to fuel the vehicle and the incremental vehicle cost (alternative VS traditional fuel). Search and find incentives, grants and rebates. Then with the amount of fuel and labor used compute the cost savings (or higher cost) and the ROI (if any).



ELECTRIC VEHICLES

- *Range in size from small cars, sports cars, to busses and soon Semi Tractors
- *Fast charge stations are available and can give a significant charge in as little as 15 minutes.
- *Large electric trucks and busses are becoming available from OEM and some conversions



HYBRIDS: ELECTRIC AND HYDRAULIC

- *Both technologies add cost but after doing all of the math can save money in the long term
- *Electric Hybrids typically use gasoline and electric power, some are plug ins
- *Hydraulic Hybrids build up hydraulic pressure and reduce fuel consumption when the use that power.



ETHANOL

Ethanol is readily available and can be used as E-85 in vehicles designated to use it. Ethanol should cost less per gallon than gasoline but has less energy per gallon. Expect to get 15-25% less MPG. Using Ethanol can save money if the price is right. All gasoline in the area is E-10, some places offer custom blends.



BIODIESEL

Chris Schmale,

Biodiesel Sales,
Renewable Energy Group (REG)
Work (515) 239-8106
Email: chris.schmale@REGI.com



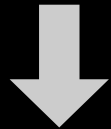
BIODIESEL

- Increased Engine Performance
- Decreased Tailpipe Emissions
- Fuel Cost Savings
- No Upfront Investments



REG – AMERICA'S #1 BIODIESEL PRODUCER

13
Biomass-Based
Diesel Plants



502
MMGY
NAMEPLATE
CAPACITY

Multiple Feedstock Capable



Albert Lea, MN



Danville, IL



Emden, Germany



Geismar, LA



Madison, WI



Mason City, IA



New Boston, TX



Newton, IA



Oeding, Germany



Seneca, IL

Refined Feedstock



Grays Harbor, WA



Houston, TX



Ralston, IA

Fermentation Facility



Okeechobee, FL

Feedstock Proc. Facility



Burlo, Germany

Partially Completed or Repairs Required



WHAT IS BIODIESEL?

- Biodiesel is methyl esters made from biological oils and fats (triglycerides) by transesterification*



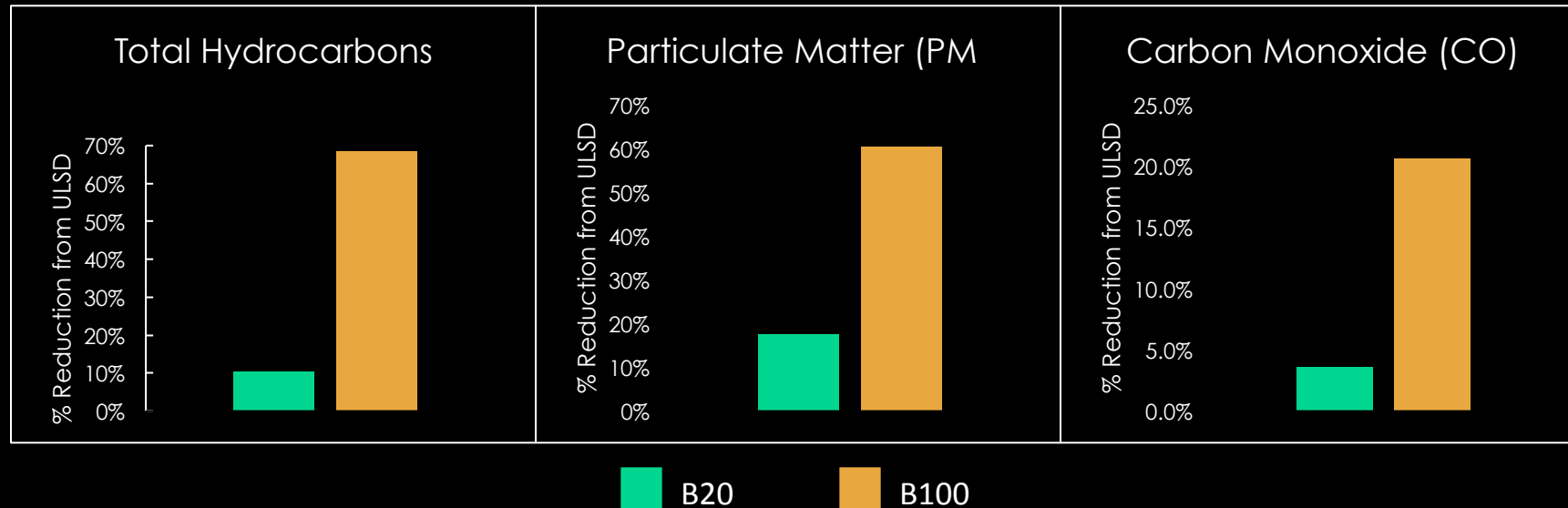
**Transesterification is the process of swapping one alcohol (i.e. methanol) for another alcohol (i.e. glycerol)*

BIODIESEL BENEFITS

- Blends with petrodiesel in any percentage
- Higher Cetane
- Higher Lubricity
- Virtually Zero Sulfur
- Zero Aromatics
- High Flash Point
- Low Emissions



BIODIESEL BENEFITS



Note: All emissions data taken from 2006 Cummins ISM 370 on Federal Test Procedure driving cycle, as reported in Durbin, Thomas D., et al. "CARB Assessment of the Emissions from the Use of Biodiesel as a Motor Vehicle Fuel in California "Biodiesel Characterization and NOx Mitigation Study". California Air Resources Board: Sacramento, CA (2011). Comparisons with Federal ULSD were conducted based on a linear comparison with CARB ULSD data. All biodiesel data shown is taken as an average of the means of high and low cloud point biodiesel emissions results, where available.

ILLINOIS TAX INCENTIVE

- B1 – B10 Blends: Retailers are exempt from 20 percent of the state's 6.25 percent sales tax
- B11 or Greater: Full exemption
- \$2.00/gallon diesel price = \$.125/gallon savings
- A company using 500,000 gallons/month = \$62,500 savings/month for using biodiesel blends of B11 or greater



NATURAL GAS AND PROPANE

Adam Goldstein,

Managing Partner

Stag USA

Cell: (317) 985-3244

Email: goldstein@stagusa.us



Natural Gas

Natural Gas

Hydrocarbons, predominantly methane (CH_4)

High octane rating

Nontoxic, noncorrosive, and noncarcinogenic

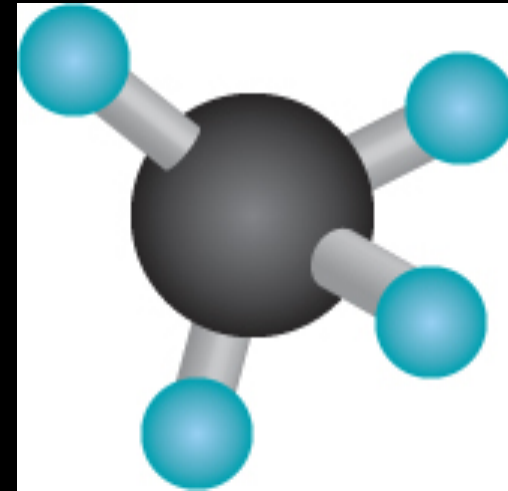
Not a threat to soil, surface water, or groundwater

Extracted from gas and oil wells

Existing pipeline distribution system

The USA has an abundance on natural gas

Can be made from methane from landfills and water reclamation.



Natural Gas: CNG and LNG

Compressed Natural Gas (CNG)

- Stored in onboard tanks under high pressure
- Fuel economy similar to gasoline
- 1 GGE = 5.7 lb CNG

Liquefied Natural Gas (LNG)

- Kept at cold temperatures
- Stored in double-wall, vacuum-insulated pressure vessels
- Heavy-duty vehicles
- 1 GGE = 1.5 gal LNG



- Also known as liquefied petroleum gas (LPG)
- Colorless, odorless liquid (when stored under pressure)
- High octane rating
- Nontoxic
- By-product of natural gas processing and crude oil refining
- Less than 2% of propane used in U.S. used in transportation
- Lower GHG emissions



Propane Vehicle Availability

- Light-duty vehicles available
- Engines and fueling systems for heavy- and medium-duty vehicles
- Conversions

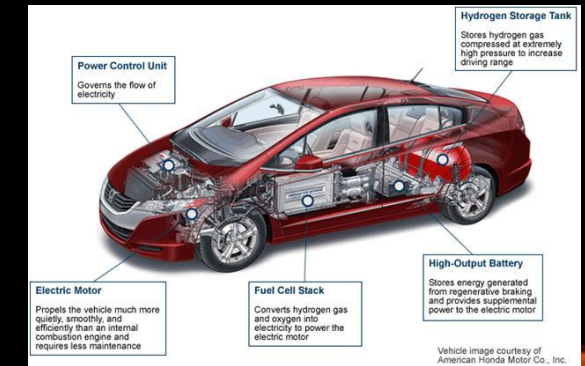


John W. Walton,
Chair, Chicago Area Clean Cities,
Advance Fueling Consultants
Cell: 630-240-8858
Email: jwalton@advancefueling.com



HYDROGEN

This I believe is the fuel of the future, but will be a long time till it is practical. There is some regional availability now.



EXHAUST RETROFITS

- Diesel oxidation catalysts (DOCs)
- Diesel particulate filters (DPFs)
- Selective catalytic reduction (SCR) systems
- Crankcase ventilation (CCV) filter systems - No fuel savings, no cost recovery – seek grants
- EPA and California ARB verify the efficacy of these devices and require compatibility with legacy engines – verification required to obtain grant funding

SO, WHAT TO DO TODAY

- *Driver Training can save a lot of fuel
- *Biodiesel and ethanol are easy and readily available
- *CNG, LNG and LPG fuel cost is much more stable than diesel and gasoline
- *Electric and Hybrid vehicles are readily available. Infrastructure is being built. Personal cars can charge at home or work.



THE BEST PLACE TO LOOK FOR ADVICE AND
INFORMATION

Samantha Bingham,

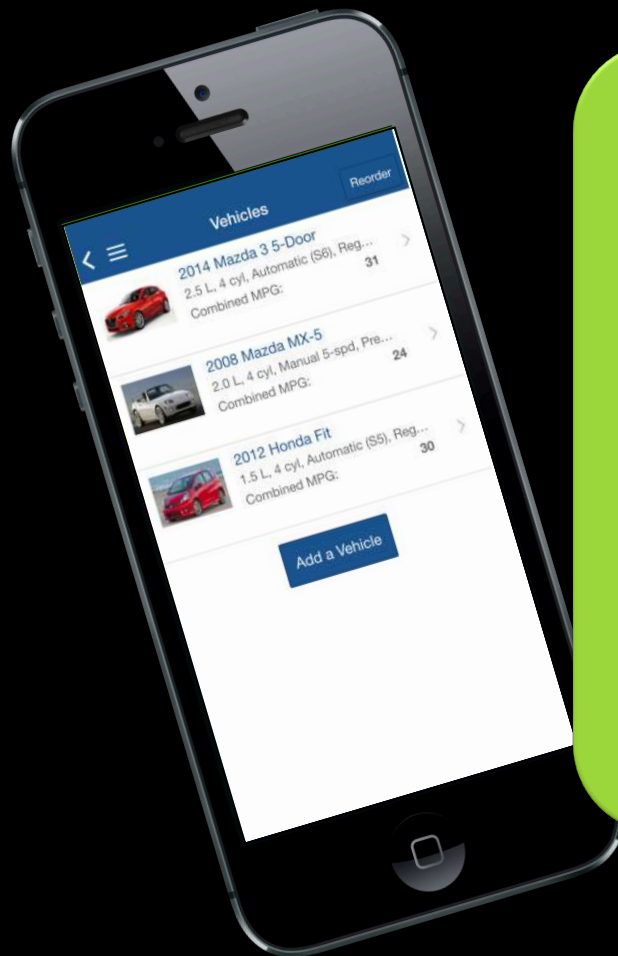
Coordinator, Chicago Area Clean Cities, City of Chicago

Work: (312) 744-8096, Email:

samantha.bingham@cityofchicago.org



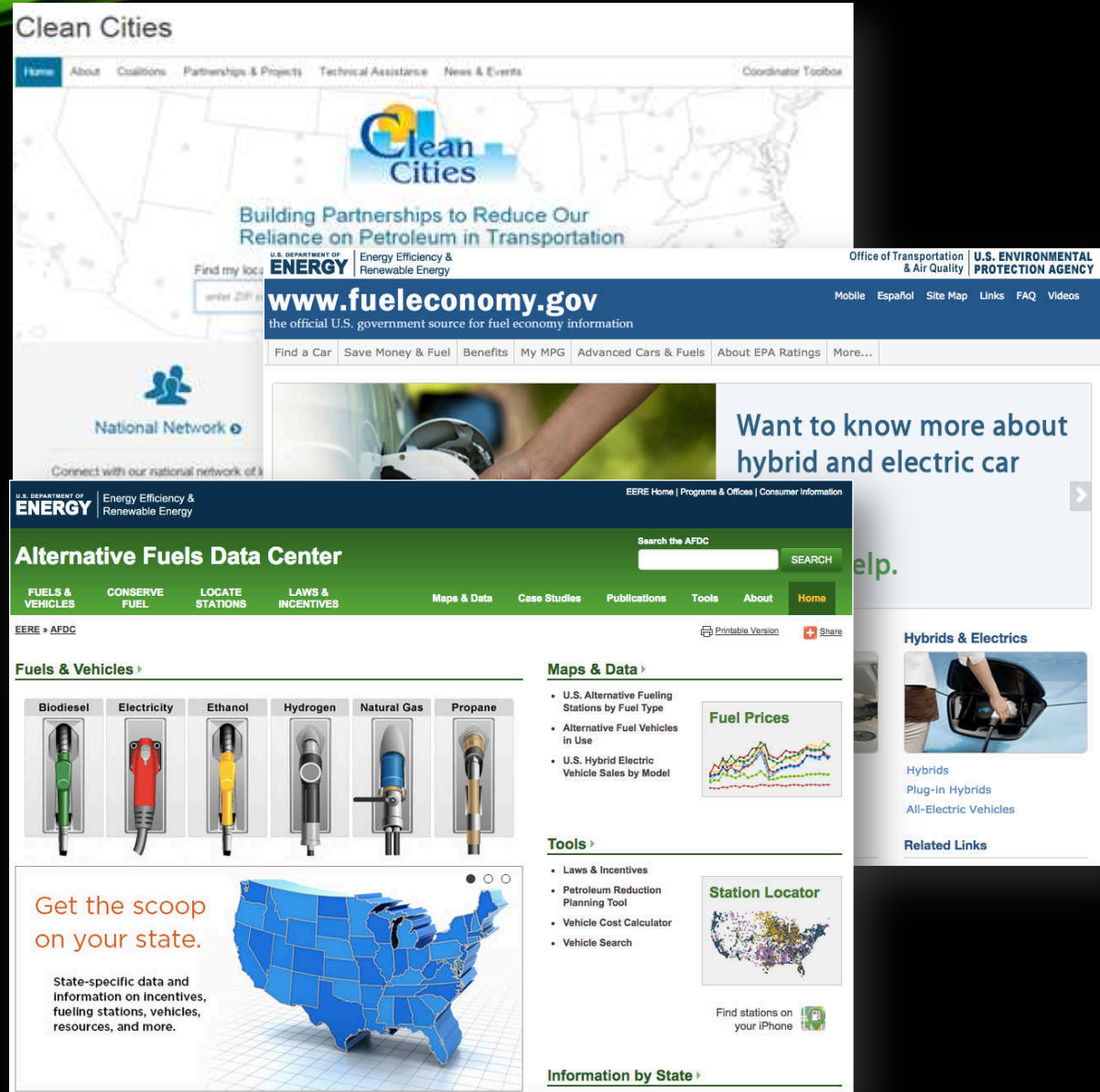
CLEAN CITIES WEB-BASED TOOLS & RESOURCES



- Websites
- Publications
- Technical Assistance
- Toolkits
- News Sources
- Online Tools



- **Clean Cities Website**
 - Program Overview
 - Goals & Accomplishments
 - Information Resources
 - News.
- **Alternative Fuels Data Center**
 - Station Locator
 - Laws & Incentives
 - Maps & Data
 - Case Studies
 - Publications
 - Tools & Widgets.
- **FuelEconomy.gov**
- **Spanish Language Resources**
- **Additional Resources**



<https://cleancities.energy.gov/>

AFDC TOOLS

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

EERE Home | Programs & Offices | Consumer Information

Alternative Fuels Data Center













Search the AFDC [SEARCH](#)

[FUELS & VEHICLES](#) [CONSERVE FUEL](#) [LOCATE STATIONS](#) [LAWS & INCENTIVES](#) [Maps & Data](#) [Case Studies](#) [Publications](#) [Tools](#) [About](#) [Home](#)

[EERE](#) » [AFDC](#) » [Tools](#) [Printable Version](#) [Share](#)

Tools

The Alternative Fuels Data Center offers a large collection of helpful tools. These calculators, interactive maps, and data searches can assist fleets, fuel providers, and other transportation decision makers in their efforts to reduce petroleum use.

 <h4>Calculators</h4> <div><h5>Vehicle Cost Calculator</h5><p>Compare cost of ownership and emissions for most vehicle models. mobile</p></div> <div><h5>Petroleum Reduction Planning Tool</h5><p>Create a plan for your fleet to reduce petroleum consumption and emissions.</p></div> <div><h5>CNG VICE Model 2.0</h5><p>Evaluate ROI and payback period for natural gas vehicles and infrastructure.</p></div>	 <h4>Interactive Maps</h4> <div><h5>Alternative Fueling Station Locator</h5><p>Locate alternative fueling stations and get maps and driving directions. mobile</p></div> <div><h5>TransAtlas</h5><p>Analyze vehicle densities and locations of fueling stations and production facilities.</p></div> <div><h5>BioFuels Atlas</h5><p>Compare feedstocks and analyze biofuel production by location.</p></div>	 <h4>Data Searches</h4> <div><h5>Vehicle Search</h5><p>Compare light-duty alternative fuel vehicles, electric vehicles, and hybrids.</p></div> <div><h5>Laws and Incentives Search</h5><p>Search for laws and incentives related to alternative fuels and advanced vehicles.</p></div> <div><h5>Fuel Properties Comparison</h5><p>Compare alternative fuel properties and characteristics.</p></div>
---	--	--

Bookmark it!

WWW.AFDC.ENERGY.GOV

THE BEST DECISION

The best fuel to use in your fleet is...

What works best in your situation and meets your “green” requirements and ROI needs.



GASOLINE-GALLON EQUIVALENTS OF VARIOUS FUELS

Fuel Type	Unit of Measure	BTUs Per Unit	Gallon Equivalent
Gasoline, regular unleaded, (typical)	gallon	114,100	1.00 gallon
Gasoline, RFG, (10% MBTE)	gallon	112,000	1.02 gallons
Diesel, (typical)	gallon	129,800	0.88 gallons
Liquid natural gas (LNG), (typical)	gallon	75,000	1.52 gallons
Compressed natural gas (CNG), (typical)	cubic foot	900	126.67 cu. ft.
Liquefied petroleum gas (LPG or propane)	gallon	84,300	1.35 gallons
Methanol (M-100)	gallon	56,800	2.01 gallons
Methanol (M-85)	gallon	65,400	1.74 gallons
Ethanol (E-100)	gallon	76,100	1.50 gallons
Ethanol (E-85)	gallon	81,800	1.40 gallons
Bio Diesel (B-20)	gallon	129,500	0.88 gallons
Electricity	kilowatt per hour	3,400	33.53 kwhrs

FOR MORE INFORMATION

John W. Walton, Chair, Chicago Area
Clean Cities, Advance Fueling Consultants
Cell: 630-240-8858
Email: jwalton@advancefueling.com



Samantha Bingham, Coordinator,
Chicago Area Clean Cities, City of Chicago
Work: (312) 744-8096, Email:
samantha.bingham@cityofchicago.org



Adam Goldstein, Managing Partner
Stag USA
Cell: (317) 985-3244
Email: goldstein@stagusa.us



Chris Schmale, Biodiesel Sales, Renewable
Energy Group (REG)
Work (515) 239-8106
Email: chris.schmale@REGI.com

