

Midwest Renewable Energy Laboratory

REAL WORLD - REAL SOLUTIONS
2003 Energy

E-Tools for Evaluating Alternative Fuel and Advanced Technology Vehicles

Clean Cities

August 18, 2003

Kevin O'Connor
National Renewable Energy Laboratory

Operated for the U.S. Department of Energy by Midwest Research Institute • Battelle • Bechtel

Energy 2003

REAL WORLD - REAL SOLUTIONS
2003 Energy

Please be courteous to your audience...




Turn off all cell phones and set pagers to vibrate... Thanks

Course Topics

REAL WORLD - REAL SOLUTIONS
2003 Energy

- History
- Alternative Fuels - Why Should We Care?
- What Is Clean Cities?
- AFVs - What Fuels? What Vehicles?
- Internet Tools of the Trade for the Fleet Manager (and others)
- Can we Make the Case for AFVs?
- The Future - Where Are We headed?
 - Hybrids? Hydrogen? Fuel Cells?

Stimulus for AFVs



History

REAL WORLD - REAL SOLUTIONS
2003 Energy

- Alternative Fuels Motor Act (AMFA) – 1988
- Clean Air Act Amendments (CAAA) – 1990
- Energy Policy Act (EPAAct) – 1992
- Executive Order 13149 (*Greening the Government through Federal Fleet and Transportation Efficiency*)

History and the Future

Alternative Fuels and AF Vehicles: Why Should We Care?

- Energy Independence
- Cleaner Air
- U.S. Economic Benefits – we need to care?
- Homeland Security

Energy Security

- Where is the oil?
- Who Controls it?
- Our Appetite

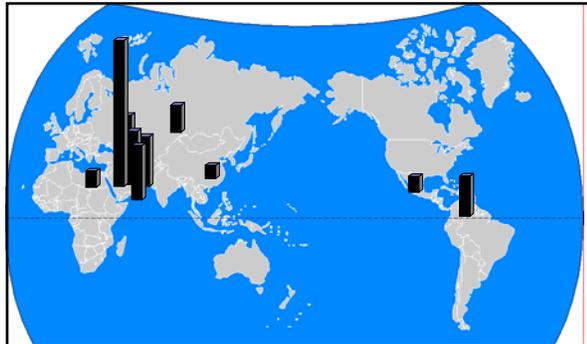
Propane One



Photo by AP

"It's good for our air, it's good for our economy and it's good for our national security."

- President Bush on public policy supporting alternative fuel



Where are all the oil reserves?

U.S. Oil Supply & Demand



Crude Oil Production
5.8 million bbl/day 9%
of world total

Oil Reserves
21.8 billion bbl
2% of world total



Oil Imports
10.5 million bbl/day
53% of U.S. oil
consumption



Oil Consumption
19.7 million bbl/day
26% of world total

International Oil Use – Industrialized Countries

	1999 (Quad. Btu)	2020 (Quad. Btu)
North America	45.8	66.2
Western Europe	28.7	32.5
Industrialized Asia	13.9	16.8
Total Industrialized	88.4	115.6
Eastern Europe/ Former Soviet Union	10.8	21.1

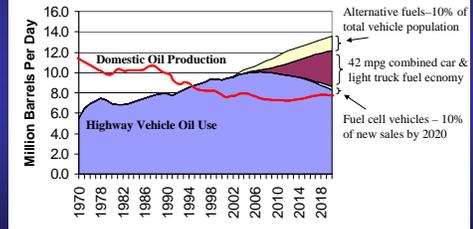
International Oil Use – Developing Countries

	1999 (Quad. Btu)	2020 (Quad. Btu)
Developing Asia	27.7	59.9
Middle East	10.5	16.4
Africa	5.2	10.9
Central & South America	9.5	18.1
Total Developing	52.9	105.2
Total World	152.2	241.8

Cost to the Nation

Economy  \$90.5 billion spent in 2001 for oil imports	Health <ul style="list-style-type: none"> • Asthma • Bronchitis • Shortness of breath • Lost work days
Environment  <ul style="list-style-type: none"> • Air pollution • Global warming • Water pollution 	Defense \$8.9 trillion spent on defense over past 30 years, some to defend "oil allies"

Alternative Fuels and Improved Fuel Economy Can Reduce Oil Dependence



Clean Cities



- ✓ Public Private Partnerships
- ✓ Voluntary Program
- ✓ 80 Designated Clean Cities in U.S.
- ✓ 4,700 Stakeholders
- ✓ Clean Cities is 10 years old
- ✓ Established in Response to EPAct



Clean Cities Coalitions



Clean Cities Program Goals

- Support the Energy Policy Act (EPAct 1992)
- 1 billion gallons fuel displacement annually by 2010
- 75% of coalitions self-sustaining by 2005



Alternative Fuels - Review

Alternative Fuels as defined by EPAct

- Natural Gas (CNG, LNG)
- Ethanol (E85)
- Methanol (M85)
- Electric
- Propane (LPG)
- Biodiesel
- Hydrogen



AFV Web Tools and Information

- What Tools Are Available?
- Why Should You Use Them?
- Where Can the Tools be Found?
- How Easy Are They To Use?



Some Available Tools

- Vehicle Buyer's Guide
www.ccities.doe.gov/vbg
- Clean Cities Web Site
www.ccities.doe.gov
- Alternative Fuels Data Center
www.afdc.doe.gov



The Clean Cities Web Site

CCITIES URL: www.ccities.doe.gov

- Map and Contact Information
- What is CC – Roadmap and Success Stories
- Support & Funding
- CC International
- Link to Buyers Guides (LDV, HDV, Refueling)
- Coordinator's Toolbox
- Success Stories – Niche Markets
- Conferences and Events



Examples: "AFV Information"

- Light-Duty AFVs
- Heavy-Duty AFVs
- AFV Resale Information
- GSA Fleet, AFV Sales
- Refueling Stations
- EPAct Fleet Information & Regulations
- Federal AFV USER Program
- Emissions Data and Air Quality
- Legislative Information
- OEM/Dealer Locations



Let's Talk Emissions

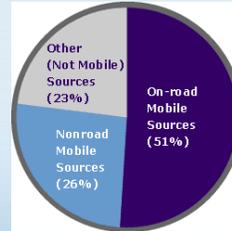
www.epa.gov/otaq/inventory/overview/pollutants

Criteria (most serious) pollutants

- Carbon Monoxide (CO)
- Non-Methane Hydrocarbons (NMHC)
- Nitrogen Oxides – (NO_x)
- Particulate Matter (PM)

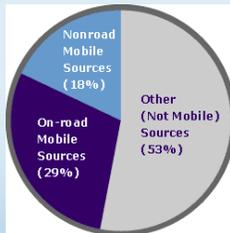
Let's Talk Emissions

1999 National Emissions by Source:
Carbon Monoxide



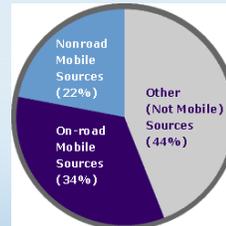
Let's Talk Emissions

1999 National Emissions by Source:
Hydrocarbons



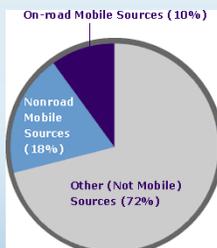
Let's Talk Emissions

1999 National Emissions by Source:
Nitrogen Oxides



Let's Talk Emissions

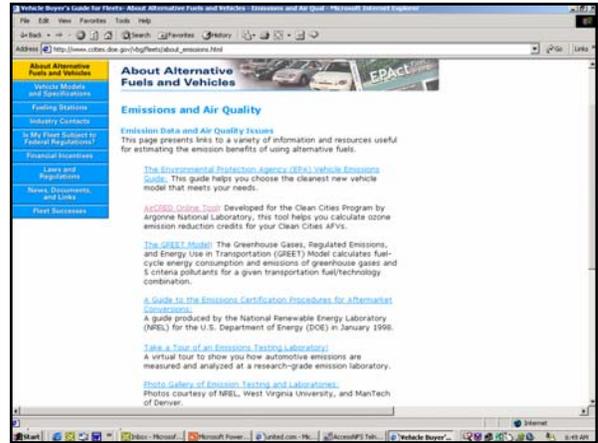
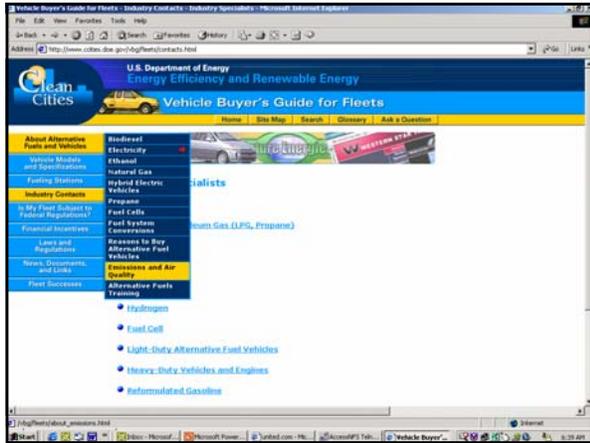
1999 National Emissions by Source:
Particulate Matter



Emissions Estimation Tools

www.afdc.doe.gov/afv/emissions.shtml

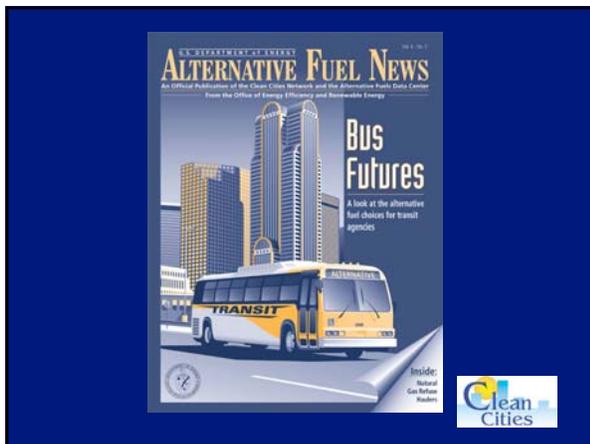
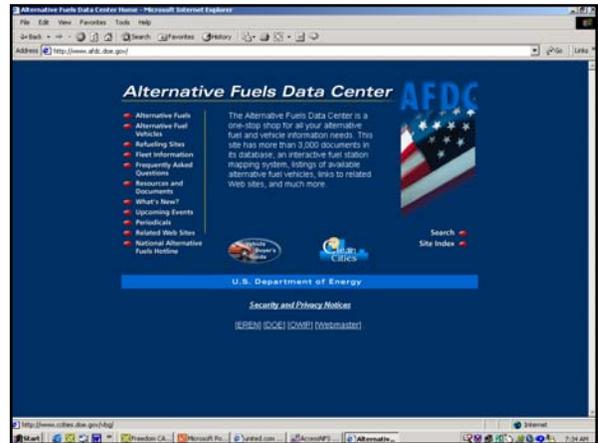
- AirCRED Tool (Argonne National Laboratory)
- Green Vehicle Guide (EPA)
- GREET Model (Argonne National Laboratory)
- Emissions Testing Lab Tour
- Other resources



Alternative Fuels Data Center

A major source for alternative fuel and AFV information (www.afdc.doe.gov), including:

- Information and Documents
- Alt fuels and vehicles
- Refueling Sites
- Fleet Information
- Frequently Asked Questions – Hotline
- Alternative Fuel News
- Upcoming Events
- Related Web Sites
- Emissions information
- Technical Assistance – Tiger Teams
- What's New?



Vehicle Buyer's Guide

www.ccities.doe.gov/vbg

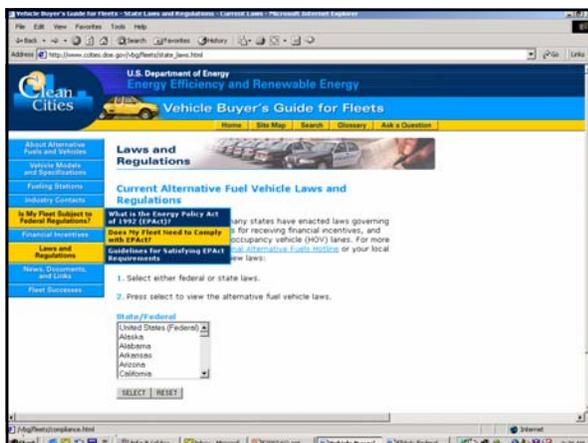
- General Information on AFVs
- Vehicle Buyer's Guide for Consumers
- Vehicle Buyer's Guide for Fleets

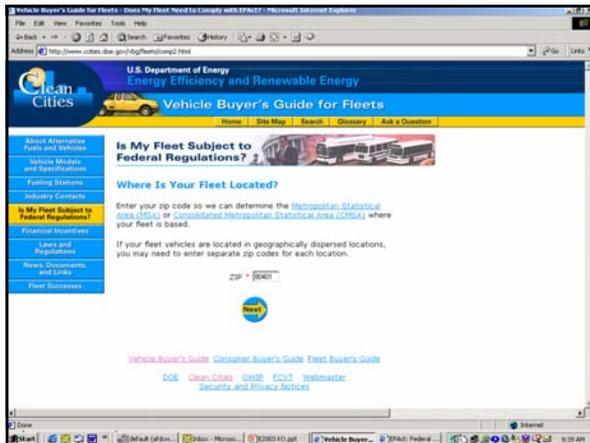


Using the AFV Fleet Buyer's Guide Tool

www.fleets.doe.gov

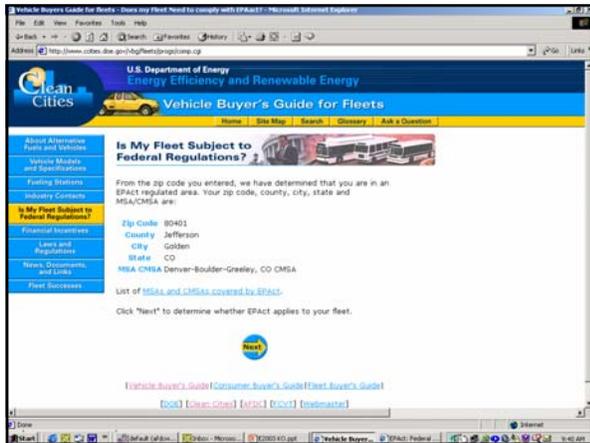
- Tell us about yourself
- Do regulations apply?
- If you must or want to, how do you buy an AFV?





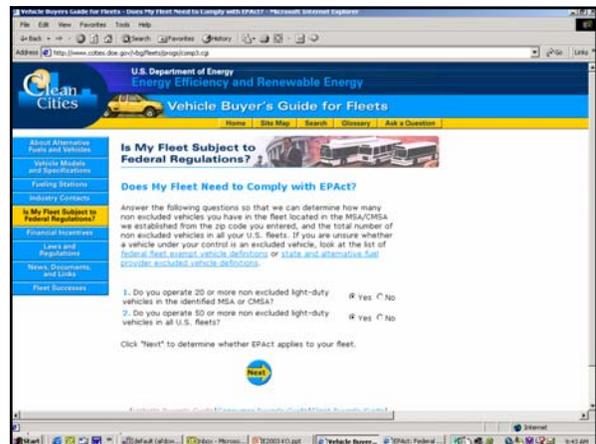
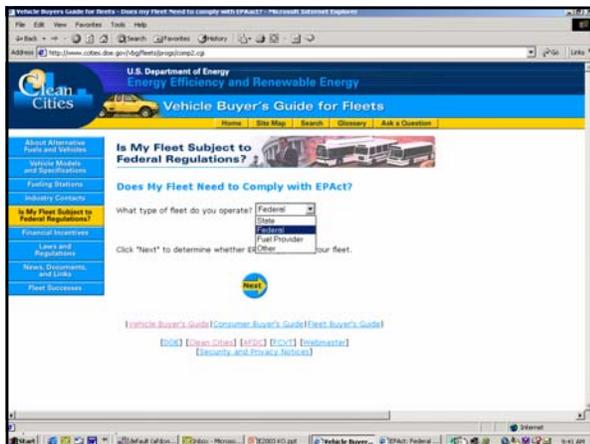
Using the AFV Fleet Buyer's Guide Tool

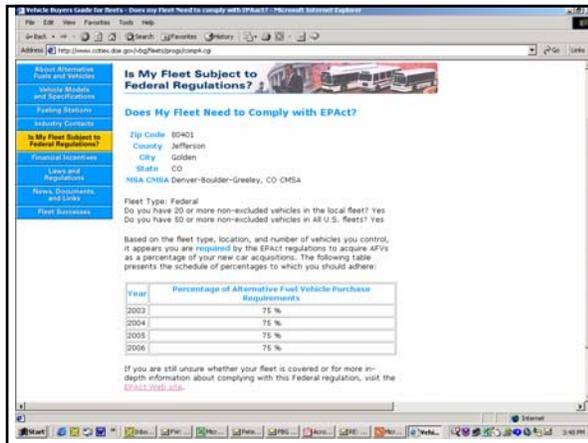
Now Here's What We Know About You...



Using the AFV Fleet Buyer's Guide Tool

Now Tell Me More About Your Fleet Characteristics





Using the AFV Fleet Buyer's Guide Tool

What You Said...

- Federal Fleet
- Covered CMAA
- 50 or more non-excluded vehicles
- 20 or more capable of central fueling

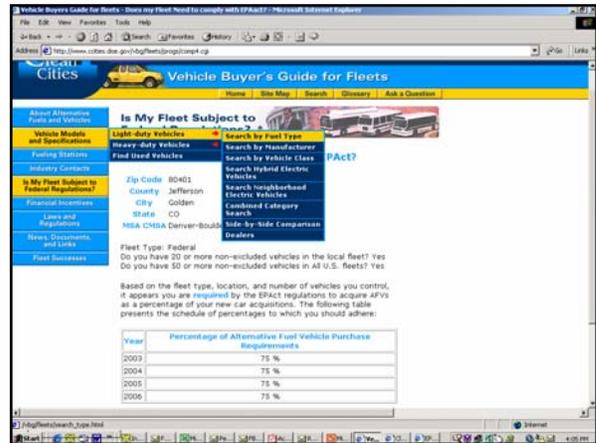
What You Must Do...

- Annually, 75% of all new new purchases must be AFVs from 2003-2006 (currently)
- 20% reduction in petroleum consumption by 2005 compared FY 1999 fuel consumption (EO 13149).

Using the AFV Fleet Buyer's Guide Tool

OK, You Need To Comply... What Vehicles Are Available?

Select 'Vehicle Models and Specifications' from the menu.



Using the AFV Fleet Buyer's Guide Tool

I Can Do a Side-By-Side Vehicle Comparison?

Side-by-Side Comparison

- Select one or more fuel types for vehicles that you would like to compare and then click the select button. Select multiple fuel types by holding down the control key and clicking on the fuel types you are interested in.
- Select multiple vehicles for side-by-side comparison by clicking the check box in the lower portion of each vehicle record. Then press the Select for side-by-side button to view the selected vehicles side-by-side.

Side-by-Side Comparison		
	2003 DaimlerChrysler Dodge Ram Van 800-999-FLEET	Emission Certification 3LEV ULEV
<input type="checkbox"/>	Check for Side-by-Side Comparison	
	2003 DaimlerChrysler Dodge Ram Van 800-999-FLEET	Emission Certification 3LEV ULEV
<input type="checkbox"/>	Check for Side-by-Side Comparison	
	2003 Ford Motor Co. Crown Victoria 1-800-34-feet	Emission Certification ULEV
<input type="checkbox"/>	Check for Side-by-Side Comparison	
	2003 Ford Motor Co. E 250 Van	Emission Certification
<input type="checkbox"/>	Check for Side-by-Side Comparison	

Light-duty Vehicle Side-by-Side Comparison

VEHICLE MAKE	Ford Motor Co.	Honda
VEHICLE MODEL	Crown Victoria	Civic GX
MODEL YEAR	2003	2003
VEHICLE CATEGORY	Sedan	Sedan
VEHICLE WEIGHT CATEGORY	Light-Duty Vehicle	Light-Duty Vehicle
FUEL TYPE CODE	Natural Gas	Natural Gas
FUEL CONFIGURATION	Dedicated	Dedicated
EMISSION CERTIFICATION STANDARD	ULEV5	ULEV SULEV
STICKER PRICE		20510
ESTIMATED DRIVING RANGE (CITY)		200
FUEL ECONOMY (CITY)	13	30
FUEL ECONOMY (HWY)	18	34
DRIVE	rear-wheel	front-wheel
TRANSMISSION TYPE	electronic, 4-speed automatic	Automatic (CVT)
PEARL HORSEPOWER	175 @ 4750	110 @ 6300 rpm
PEAK TORQUE	235 @ 2000	96.2 @ 5500 rpm
ACCELERATION TIME 0-60		0

VEHICLE SPECIFICATIONS

RATING (LBS)	2599
CURB WEIGHT (LBS)	2945
SEATBELT/INSEATBELT	1500
IS THIS A GSA VEHICLE?	Y
ENGINE TYPE	SEFI
ENGINE SIZE	4.6 L
NUMBER OF ENGINE CYLINDERS	4
FUEL TANK CAPACITY	0
NUMBER OF BATTERIES	0
BATTERY WEIGHT	0
ALT FUEL TANK CAPACITY	11.9
GASOLINE EQUIV. STICKER PRICE	16010
GASOLINE EQUIV. ECONOMY (CITY-MPG)	18
GASOLINE EQUIV. ECONOMY (DRY-NGO)	26
FUEL ECONOMY (CITY) UNITS	MPGGE
FUEL ECONOMY (HWY) UNITS	MPGGE
DEALER LOCATOR BODY NUMBER	1-800-34-feet
WHERE AVAILABLE	ALL
AVAILABLE FOR PURCHASE	Yes
AVAILABLE FOR LEASE	Yes
VEHICLE TYPE	AFV
INCREMENTAL COST	6780

Using the AFV Fleet Buyer's Guide Tool

Now, Perform the Vehicle Fuel Cost Savings Analysis

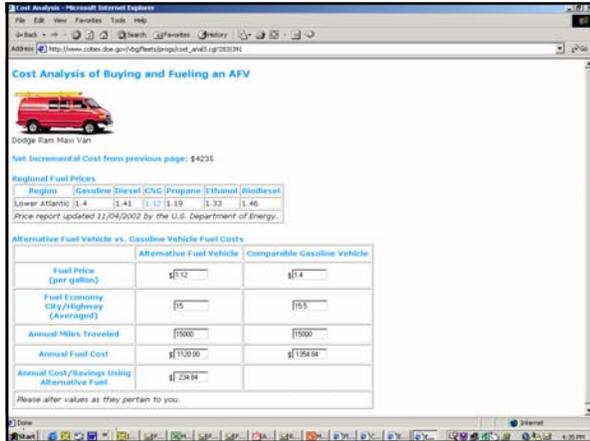
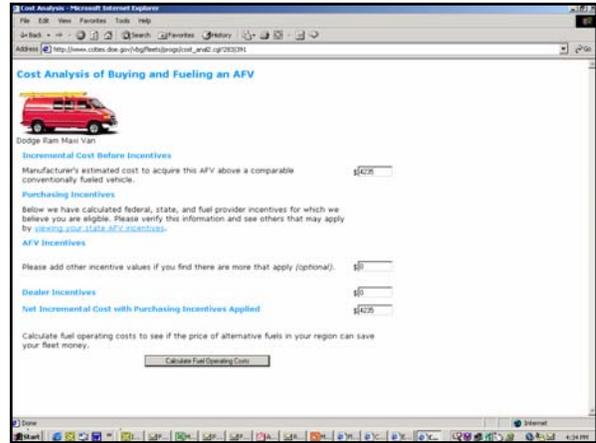
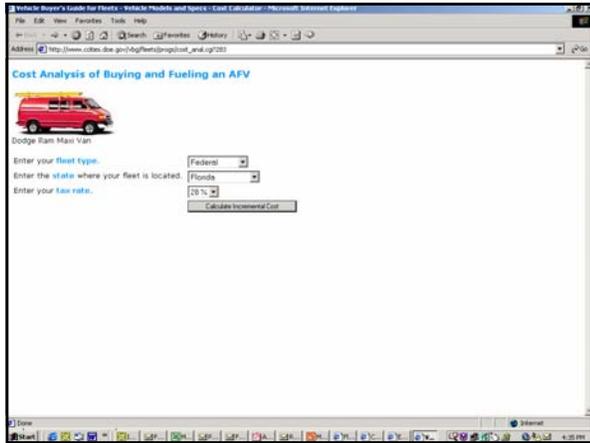
Vehicle Models

Light-duty Vehicles
Heavy-duty Vehicles
Fleet Used Vehicles

Search by Fuel Type
Search by Manufacturer
Search by Vehicle Class
Search by Annual Electric Vehicle
Search by Neighborhood Electric Vehicle
Combined Category Search
Side-by-Side Comparison
ULEV, and California SULEV

	2003 DaimlerChrysler Dodge Ram Van 800-999-FLEET	Emission Certification 3LEV ULEV	Incremental Cost \$4235	Transmission and Engine 4-speed automatic Magnam 5.2 L
City MPG	11	Heavy MPG	19	
Dealer Locator URL:	http://www.fleet.buyersguide.com/dealer.asp			

City MPG: 11, Heavy MPG: 19, Transmission and Engine: 4-speed automatic Magnam 5.2 L, Emission Certification: 3LEV ULEV, Incremental Cost: \$4235, Fuel Type: Natural Gas Dedicated.



AFVs Available - 2003 MY

Natural Gas LDVs

- **Dedicated CNG Vehicles**
 - Honda Civic GX
 - Dodge Ram Van/Maxi Van
 - Ford Crown Vic, F-150, E-Series Van and Wagon
 - Chevy Express, GMC Savana

AFVs Available - 2003 MY

Bi-Fuel CNG/LPG LDVs

- Ford F-150 (CNG/LPG)
- Chevy Silverado, GMC Sierra
- Chevy Express, GMC Savana
- Chevy Cavalier

AFVs Available - 2003 MY

Flex-Fuel Ethanol (E85) LDVs

- Chrysler Town and Country, Dodge Caravan/Grand Caravan - Minivan
- Chrysler Sebring, Dodge Stratus Sedans
- Ford Taurus Sedan, Mercury Sable Wagon
- Ford Explorer/Sport; Mercury Mountaineer SUVs; Ford Ranger LD Pickup
- Chevy Tahoe, Suburban SUV; GMC Yukon/Yukon-XL/ SUV
- Chevy Silverado; GMC Sierra - LD Pickup
- Mazda B300 - LD Pickup

AFVs Available - MY 2003

Electric Vehicles

- Nissan Altra-EV Mid-Size Wagon lithium-ion
- Nissan Hypermini (lithium-ion)
- Solectria Citivan (Lead-Acid)



AFVs Available - 2003 MY

Heavy Duty Vehicles - chassis examples:

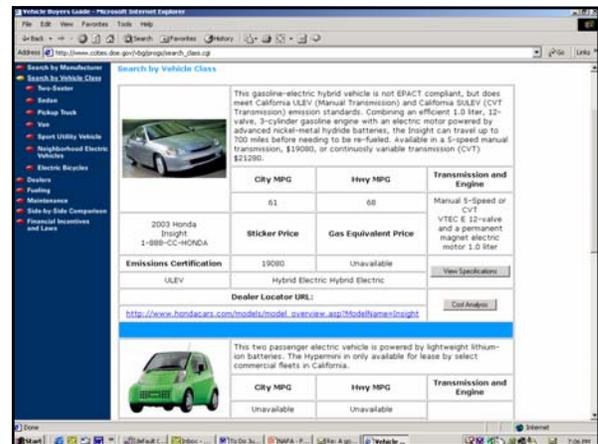
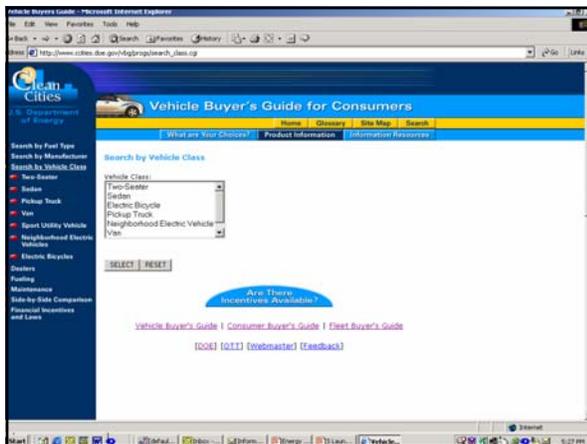
- Transit Buses
- Paratransit Buses
- School Buses
- Shuttles/Airport Shuttles
- HD Trucks
- Street Sweepers & Refuse Haulers

Note: Many fuels represented by the engine options available for the chassis.

Using the AFV Fleet Buyer's Guide Tool

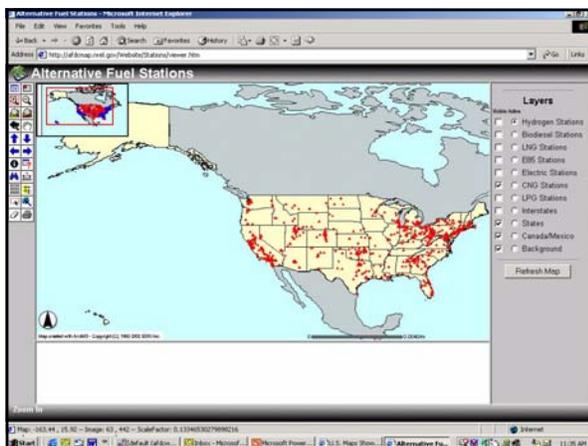
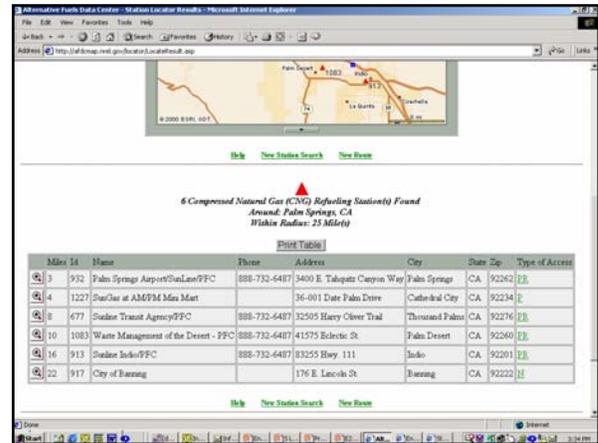
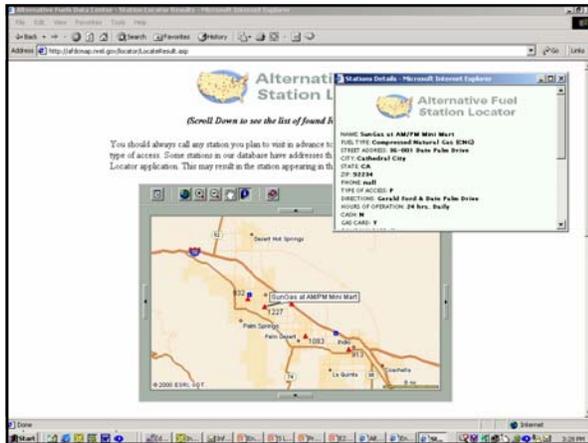
Are there other Advanced Technology Vehicles that you could look at?

Yes - check out the Buyers Guide for Consumers from the Clean Cities home page (ccities.doe.gov) or go to <http://www.ccities.doe.gov/vbg/consumers/> Then, select the class of vehicle in which you are interested or choose a variety of other tools related to product information. **Remember, gasoline hybrid vehicles are not EPAAct compliant.**



Using the AFV Fleet Buyer's Guide Tool

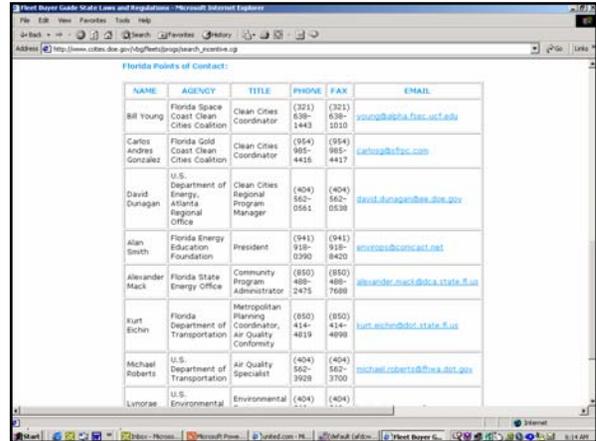
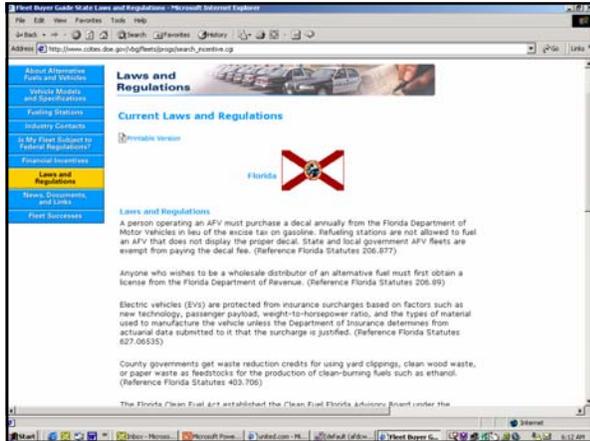
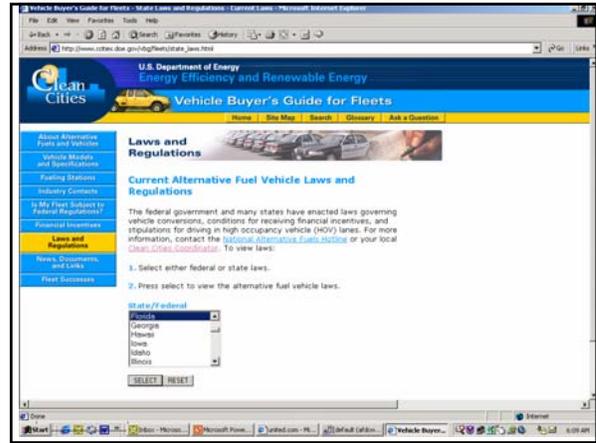
All right, you know what you want and need. Are there any refueling sites for the fuel you have chosen?



Using the AFV Fleet Buyer's Guide Tool

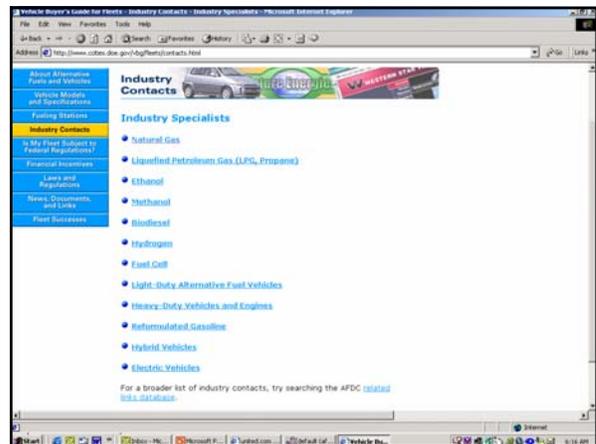
You'd like to know more about Incentives and Laws -- Federal, State, and Local -- that might apply to you. What do you do?

Select 'Laws and Regulations' from the menu on the Vehicle Buyer's Guide for Fleets.



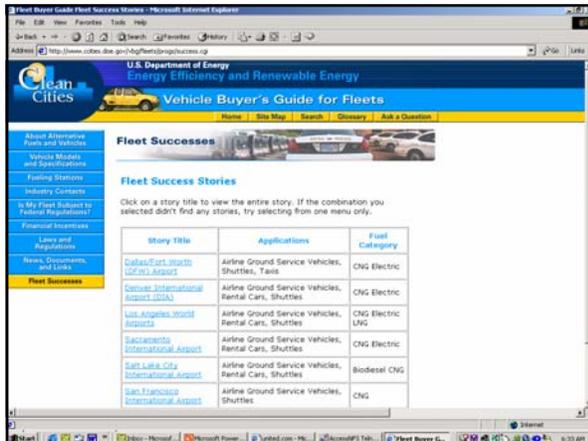
Using the AFV Fleet Buyer's Guide Tool

What about other industry contacts? Maybe I'd like to talk with experienced experts. Any ideas?



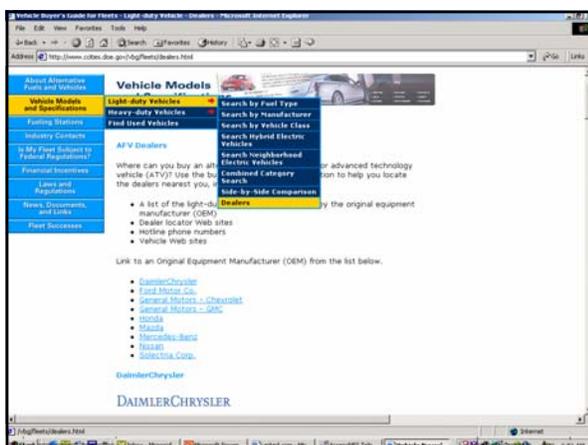
Using the AFV Fleet Buyer's Guide Tool

Where can I find real-world success stories? For example, I am interested in CNG airport ground services vehicles.



Using the AFV Fleet Buyer's Guide Tool

What about dealers in your area selling AFVs? Can I receive help there?



DOE's Private and Municipal Fleet Rulemaking

What are the implications and considerations?

- DOE must rule because of environmental litigation
- Will DOE's 30% petroleum goal be changed?
- Would the P&L rule contribute significantly?
- Could the P&L rule be enforced? At what cost?
- If passed, would require fleets to begin purchasing % of new vehicles as AFVs
- Bottom line - it won't pass

DOE's Private and Municipal Fleet Rulemaking

What are the options to the P&L rule?

- **Voluntary fleet adoption**
 - Incentives
 - Infrastructure
 - Involvement and economics (business case)
- **Niche Market Encouragement and Stimulation**
- **Do nothing – let the market evolve**
 - Hybrids
 - FFVs
 - Hydrogen

The Case for Niche Markets

Niche Market Characteristics

- Large Fleets
- Central Refueling
- Standard Routes and Distances
- Trained Maintenance Staff
- Community PR Value – Cleaner Air

The Case for Niche Markets

Major Niche Markets

- Shuttles (Airport Taxis)
- Long-Haul MD/HD (Freight and Package Delivery) Fleets on Standard Routes
- Transit Buses
- School Buses
- Delivery Fleets
- Federal Government/National Parks

The Case for Niche Markets

Local Government Possibilities

- Motor Pools
- Police Fleets
- School Buses
- Street Sweepers
- Refuse Haulers
- Support Operations



Hybrids - Where Do They Fit?

- **Advantages**
 - Interim contributor to reduce oil imports
 - Economically available now - tax incentives
 - Use current infrastructure
 - Quieter and cleaner
 - Eligible for CAAA credits
- **Disadvantages**
 - Generally petroleum based
 - Not eligible for EPA credit

Hydrogen - The Fuel of the Future?

- **Advantages**
 - Plentiful: variety of sources (NG, H₂O, methanol)
 - Clean burning - depending on energy source in production
 - Used in IC engines or fuel cells
 - Can be quieter, lower maintenance
- **Disadvantages**
 - Intense energy use in production
 - Cryogenic as a liquid if produced and transported
 - New infrastructure required
 - New vehicle engines and systems, fuel cell or IC
 - More expensive

Basics of the Hydrogen Fuel Cell

Electric Power from Hydrogen Fuel

1. Hydrogen fuel is fed into the anode of the fuel cell. Helped by a catalyst, hydrogen atoms are split into electrons and protons.
2. Electrons are channeled through a circuit to produce electricity.
3. Protons pass through the polymer electrolyte membrane.
4. Oxygen (from the air) enters the cathode and combines with the electrons and protons to form water.
5. Water vapor and heat are released as byproducts of this reaction.

From American Honda Motors Web Site

Basics of the Hydrogen Fuel Cell

Schematic of Hydrogen Fuel Cell Operation

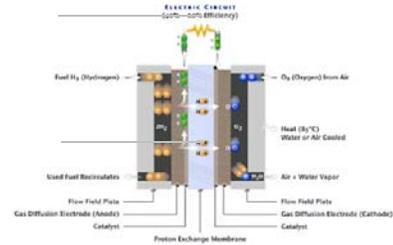


Image Courtesy of Ballard Power Systems

Making the Case for AFVs

- Case by Case Basis
- Examine the Economics
- Verify the Infrastructure
- What fuel will work for you?
- Get the commitment of your organization
- Get involved with your Clean Cities Coalition
- Learn from the Web Success Stories
- Check out incentives and rebates on Web
- Look for Funding Opportunities
- Come to the Clean Cities Conference!

Additional Information

**National Alternative Fuels and
Clean Cities Hotline**
800-423-1363 or 800-CCITIES

Primary Web Sites

- **Clean Cities:** www.ccities.doe.gov
- **Buyers Guides:** www.ccities.doe.gov/vbg
- **AFDC:** www.afdc.doe.gov
- **U.S. DOE:** www.energy.gov
- **U.S. EPA:** www.epa.doe.gov
- **DOE/EREN:** www.eren.doe.gov

See you in Ft.
Lauderdale
for the 10th
National
Clean Cities
Conference
and Expo!



Thanks for Being Here

Questions?

Comments?