

Alternative Fuel Vehicles: Continuing the Drive Towards a Cleaner Tomorrow

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Introduction

Most vehicles in the U.S. run on petroleum based fuels which emit harmful pollutants into the air. In fact, the emissions from our vehicles are the leading source of air pollution.

Today, more than half of the gasoline we put in our vehicles comes from oil imported from other countries, causing our dependence on these imports to continue to increase as we use up our domestic resources.

- Our petroleum imports cost us over \$4.4 billion a week. Most of the world's oil reserves are concentrated in the Middle East, and about two-thirds are controlled by OPEC members. Because of this, the country has experienced extreme jumps in the price of gasoline and it's hurting our economy.

Solving the Problem

In his May 2007 address to the nation, President Bush discussed the importance of solving the problem of our nation's dependence on foreign fuel. He announced his "Twenty In Ten" goal to cut U.S. gasoline consumption by 20 percent over the next ten years.

This plan supports and provides a framework to address energy security and reduce greenhouse gas emissions, by increasing the supply of alternative fuels and making motor vehicles more energy efficient.

Just one day after delivering his speech to the nation, President Bush signed an executive order requiring federal agencies that operate fleets of at least 20 motor vehicles to reduce petroleum consumption by 2 percent annually through the end of fiscal year 2015. The executive order also requires fleets to use plug-in hybrid vehicles, when plug-ins "are commercially available at a cost reasonably comparable, on the basis of lifecycle cost, to non-plug-in hybrid vehicles."

What Can the U.S. Do to Meet The Goal?

With most vehicles in the U.S. running on petroleum based fuels, the biggest environmental push is towards using alternative fuels.

In 1992, Congress passed the Energy Policy Act of 1992 (EPAAct) to reduce our nation's dependence on imported petroleum. EPAAct requires certain fleets to acquire alternative fuel vehicles, which are capable of operating on non-petroleum fuels.

Continuing to create alternative fuels which can be produced domestically from renewable sources will help achieve our goals.

What are Alternative Fuel Vehicles?

Alternative fuel vehicles (AFVs), as defined by the Energy Policy Act of 1992 (EPAct), to include any dedicated, flexible-fuel, or dual-fuel vehicle designed to operate on at least one alternative fuel.

Alternative fuel vehicles come in a variety of models such as sedans, pickup trucks, sport utility vehicles, vans, shuttle buses, medium-duty vehicles (e.g. delivery trucks), heavy-duty buses, and heavy-duty trucks.

These vehicles can easily be used in consumer or fleet applications, and incentives are available to make them cost effective for both.

Types of Alternative Fuel Vehicles

The U.S. Department of Energy acknowledges eight alternative fuels:

- Biodiesel
- Ethanol
- Electricity
- Hydrogen
- Methanol
- Natural Gas
- P-Series
- Propane

See Alternative Fuels Summary for details on each.

What are the Manufacturers Doing?

While these are the eight alternative fuels acknowledged by the U.S. Department of Energy, most are not viable options through manufacturers.

Today, many manufacturers are making it a priority to offer vehicles that are better for the environment. The two most commonly found alternative fuel vehicles are flex-fuel that operate on gasoline or ethanol blends and hybrids that operate on gasoline and electricity.

See details on manufacturer offerings.

Flex Fuel Vehicles

Flex-fuel vehicles run on ethanol (E85) fuel or traditional gasoline using just one fuel tank.

- E85 is a blend of 85% ethanol and 15% gasoline. It is domestically produced and mostly renewable because it is made of corn and other grain products. E85 also reduces gas emissions and can improve vehicle performance .
- Today, GM leads the way in manufacturing vehicles using this technology with over 2 million vehicles on the road.
- The cost of E85 fuel is typically in line with normal gasoline prices, however it has been priced lower during some peak price times.
- Stations offering E85 continue to grow. In 2006, there were over 1,200 stations. This number is expected to grow, as there are tax incentives for stations who add E85 to their offering.
- One negative to using the E85 fuel is that drivers may experience fewer miles per gallon, as the fuel holds less energy per gallon.

Hybrid Vehicles

Hybrid vehicles combine fuel and electricity to power the vehicle efficiently.

- Hybrid vehicles are known for yielding top gas mileage and greener operations; some hybrids create 50 percent fewer emissions.
- An estimated 187,000 hybrids were sold in the first six months of 2007, accounting for 2.3% of all new vehicle sales, according to J.D. Power and Associates. Although a sales slowdown is expected in the second half of the year, J.D. Power is forecasting total sales of 345,000 hybrids for the year, a 35% increase from 2006 when the current record of 256,000 hybrids were sold.
- Typically, hybrid vehicles cost more up-front, however, federal and state tax credits offer incentive to consumers who opt to buy the hybrid.
- With the recent spike in gasoline prices, consumers are even more aware of the importance of fuel economy in vehicles of all types and are turning to the hybrid as a viable option.

What's the Deal?

Vehicle Costs:

The initial purchase price of an alternative fuel vehicle is often more than a traditional fuel vehicles and the fuel costs vary; but most offer better fuel efficiencies than their gasoline counterpart. The statistics will vary by manufacturer, make and alternative fuel used.

Incentives:

To encourage use of alternative fuel vehicles, there are several incentives available at both the federal and local levels. They range from tax deductions, rebates, loan/lease options, to exemptions for parking and use of HOV lanes. Information on incentives by state is available on the U.S. Department of Energy website at http://www.eere.energy.gov/afdc/laws/incen_laws.html.

A summary of incentives is also available at Fleet Central.com at http://www.fleet-central.com/resources/State_Incentives_Alt_Fuel_Use.pdf.

Benefits of Using Alternative Fuel Vehicles

There are several benefits to using alternative fuel vehicles, but the bottom line for fleet managers is economics.

Alternative fuel vehicles are best when incorporated into:

- High-mileage fleets that consume large quantities of fuel
- Low-mileage, high-use vehicle fleets that idle or repeatedly start and stop

Fleet managers need to evaluate their vehicle uses to determine if alternative fuels are an option for their organization. If incorporated properly, over time, fleet managers will enjoy the cost savings associated with less expensive alternative fuels.

Filling Up On Alternative Fuels

Today, some alternative fuels are more accessible than others. Alternative fueling stations are popping up all across the U.S., with development plans for new infrastructures to make fueling locations more readily available to the general population.

Go to www.e85vehicles.com for a list of E85 stations in the U.S.
<http://e85vehicles.com/e85-stations.htm>

The US Department of Energy provides an online database of alternative fueling stations by state for the entire country.

Alternative Fuels Summary

Fuel	Description	Vehicle Costs	Fuel Cost	Fuel Availability	Vehicle Availability	Benefits	Notes
BioDiesel	Cleaner burning diesel fuel made from natural, renewable sources such as new and used vegetable oils and animal fats.	No additional vehicle cost, as this fuel can be used in conventional diesel engines.	Generally, biodiesel will cost \$.20 to \$.40 per gallon more than conventional diesel.	Available in at nearly 350 locations across the US.	Any existing diesel engine can use biodiesel. However, it is recommended to check with vehicle manufacturer first.	Safe, biodegradable, and reduces serious air pollutants such as particulates, carbon monoxide, hydrocarbons, and air toxics.	Is much less combustible than diesel petroleum.
Electricity	Electric powered vehicles, known as EVs, run with electricity that is stored in an energy storage device such as a battery.	Electric vehicles are priced from \$15,000 to \$40,000. Many states also offer incentives for the purchase of alternative fuel vehicles.	Electricity costs less per mile than gasoline	Most homes, government facilities, fleet garages, and businesses have adequate electrical capacity for charging EV batteries. Special hookups or upgrades may be required. Public charging facilities have been developed in some areas, including southern California and Arizona.	A limited number of EVs are currently being offered by manufacturers. Primarily seen in California and Arizona.	EV's are a zero emission vehicle, as its motor produces no exhaust or emissions. EVs don't require tune-ups, oil changes, timing belts, water pumps, radiators, fuel injectors, or tailpipes. More than 95% of the electricity used to charge EVs originates from domestic resources.	EV batteries have a limited storage capacity and their electricity must be replenished by plugging the vehicle into an electrical source. Because the range of an EV (approximately 80 miles) is limited by weight, design, and the type of battery used, EVs are particularly well suited to short-distance, high-use applications, those that demand frequent starts and stops. Well-designed EVs can travel at the same speeds as conventional vehicles and provide the same safety and performance capabilities.

Alternative Fuels Summary

Fuel	Description	Vehicle Costs	Fuel Cost	Fuel Availability	Vehicle Availability	Benefits	Notes
Ethanol	<p>Ethanol is an alcohol-based alternative fuel produced by fermenting and distilling starch crops that have been converted into simple sugars.</p> <p>Ethanol can be blended with gasoline to create E85, a blend of 85% ethanol and 15% gasoline.</p> <p>Vehicles using ethanol are often known as "flex fuel" vehicles (FFV).</p>	Ethanol powered vehicles are priced similar to or just slightly higher than conventional vehicles.	Price per gallon is comparable to gasoline.	The majority of fueling stations are located primarily in the Midwest.	FFV's are widely available with an estimated 5 million already sold in the United States, although many buyers remain unaware that they may fuel with E85.	<p>Most vehicles running on ethanol produce lower carbon monoxide and carbon dioxide emissions. And may produce the same or lower levels of hydrocarbon and non-methane hydrocarbon emissions.</p> <p>Ethanol is domestically produced and can boost the agriculture sector.</p> <p>This high-octane fuel has 80% or more of the energy content of gasoline.</p>	<p>Power, acceleration, payload, and cruise speed of vehicles operating with E85 are comparable to those operating with equivalent conventional fuels.</p> <p>Use of special lubricants may be required for FFVs</p>
Hydrogen	Hydrogen is being explored for use in combustion engines and fuel cell electric vehicles.	There are no vehicles currently available for sale to the general public.				<p>Use of hydrogen would provide stronger national energy security.</p> <p>Reduces greenhouse gas emissions which improves air quality and allows increased energy efficiency.</p>	Ford is working on the HySeries Edge, the world's first working plug-in, fuel-cell, hydrogen-powered car.

Summary Alternative Fuels

Fuel	Description	Vehicle Costs	Fuel Cost	Fuel Availability	Vehicle Availability	Benefits	Notes
Methanol	Methanol is an alcohol fuel that is produced by a process using natural gas as a feedstock.	Manufacturers no longer produce methanol-powered vehicles.				Some methanol benefits include lower emissions, higher performance, and lower risk of flammability than gasoline. Methanol can be manufactured from a variety of carbon-based feed stocks such as natural gas, coal, and biomass.	The use declined because methanol has been found to contaminate ground water.
Natural Gas	Natural gas is a mixture of hydrocarbons—mainly methane (CH ₄)—and is produced either from gas wells or in conjunction with crude oil production.	Natural gas vehicles cost somewhat higher than for similar conventional vehicles.	Natural gas can cost less than gasoline and diesel (per energy equivalent gallon).	Located in most major cities and in many rural areas. Public LNG stations are limited and used mostly by fleets and heavy-duty trucks.	Manufacturers are producing fewer models than in years past. Today, there are approximately 130,000 in the US.	These vehicles produce significantly lower amounts of harmful emissions.	Adequate training is required to operate and maintain natural gas vehicles because they are different than gasoline or diesel vehicles. Training and certification of service technicians is required.

Alternative Fuels Summary

Fuel	Description	Vehicle Costs	Fuel Cost	Fuel Availability	Vehicle Availability	Benefits	Notes
P-Series	P-Series is a unique blend of natural gas liquids (pentanes plus), ethanol, and the biomass-derived co-solvent methyltetrahydrofuran (MeTHF).	This fuel is not currently being produced in large quantities and is not widely used.					This is the only new fuel that has been recognized as an alternative fuel under the EPA Act. It was added to the list of alternative fuels in 1999.
Propane Gas	Propane blend consists of 90% propane, no more than 5% propylene, and 5% other which is primarily butane and butylene. It is produced as a by-product of natural gas processing and petroleum refining.	Vehicles cost about \$2,500 over the conventional vehicle base price.	Fuel cost is generally less than that of gasoline based on a gasoline-gallon equivalent.	Propane is the most accessible of all alternative fuels.	There are more than 200,000 propane powered vehicles, mostly in fleets.	Propane can produce fewer ozone-forming emissions can produce 60% fewer ozone-forming emissions. Approximately 85% of all propane used in this country comes from domestic sources.	Some fleets report 2-3 years longer service life and extended maintenance intervals for propane vehicles Propane vehicle power, acceleration, and cruising speed are similar to those of gasoline-powered vehicles. Range for bi-fuel vehicles is comparable to that of gasoline vehicles, but the range of dedicated propane vehicles is generally less than gasoline vehicles.

2007/2008 Hybrids Vehicles

Hybrid vehicles combine fuel and electricity to power the vehicle efficiently.

Honda

Accord
Civic

FORD

Ford Escape
Mercury Mariner
Mazda Tribute (2008)

Nissan

Altima

GMC

GMC Sierra
GMC Yukon
Chevy Silverado
Chevy Tahoe
Saturn Aura
Saturn Vue
Chevy Malibu (2008)

Toyota

Camry
Highlander
Prius – The Prius continues to be the best-selling hybrid model, accounting for just more than half of all hybrids sold.

2007/2008 Flex Fuel Vehicles (Ethanol – E85)

Flex fuel vehicles are those that run on ethanol (E85) fuel or traditional gasoline using just one fuel tank.

GM

Chevy Avalanche
Chevy Express
Chevy Impala
Chevy Monte Carlo
Chevy Suburban
Chevy Silverado
Chevy Tahoe
Chevy Uplander
GMC Savana
GMC Sierra & Sierra Classic
GMC Yukon & Yukon XL
Buick Terraza
Saturn Relay

FORD

Ford V8 Crown Victoria
Ford F-Series Pickups
Lincoln Town Car
Mercury Grand Marquis

Daimler Chrysler

Chrysler Aspen
Chrysler Sebring Sedan
Dodge Caravan, Grand Caravan and
Caravan Cargo
Dodge Dakota
Dodge Durango
Dodge Avenger (2008)
Jeep Commander
Jeep Grand Cherokee

Nissan

Titan
Armada

Lexus

LS600h

Alternative Fueling Stations - by State

STATE	BD	CNG	E85	ELEC	HY	LNG	LPG	Totals by State
Alabama	2	2	2	0	0	0	61	67
Alaska	0	1	0	0	0	0	10	11
Arizona	6	37	9	11	1	3	58	125
Arkansas	3	3	4	0	0	0	41	51
California	35	184	5	379	23	29	225	880
Colorado	24	21	29	2	0	0	67	143
Connecticut	1	10	0	3	0	0	17	31
Delaware	3	1	1	0	0	0	3	8
Dist. of Columbia	1	1	3	0	1	0	0	6
Florida	12	17	10	2	0	0	49	90
Georgia	25	19	9	0	0	0	39	92
Hawaii	7	0	0	4	1	0	4	16
Idaho	34	7	3	0	0	1	27	72
Illinois	12	14	151	0	0	0	64	241
Indiana	11	15	89	0	0	0	34	149
Iowa	13	0	70	0	0	0	24	107
Kansas	4	3	16	0	0	0	46	69
Kentucky	5	0	7	0	0	0	31	43
Louisiana	2	10	0	0	0	0	11	23
Maine	2	1	0	0	0	0	7	10
Maryland	6	15	8	0	0	0	15	44
Massachusetts	6	11	0	18	0	0	23	58
Michigan	18	13	47	0	2	0	80	160
Minnesota	3	1	307	0	0	0	31	342
Mississippi	5	0	1	0	0	0	36	42
Missouri	48	7	61	0	0	0	82	198
Montana	5	3	3	0	0	0	31	42
Nebraska	5	2	25	0	0	0	19	51

STATE	BD	CNG	E85	ELEC	HY	LNG	LPG	Totals by State
Nevada	27	11	5	0	1	0	24	68
New Hampshire	11	3	0	10	0	0	11	35
New Jersey	0	11	0	0	0	0	10	21
New Mexico	5	10	6	0	0	0	54	75
New York	8	38	6	1	0	0	28	81
North Carolina	57	11	9	0	0	0	54	131
North Dakota	0	4	23	0	0	0	15	42
Ohio	21	11	36	0	0	0	68	136
Oklahoma	9	51	1	0	0	0	71	132
Oregon	35	13	6	8	0	0	32	94
Pennsylvania	36	29	11	0	1	0	72	149
Rhode Island	0	7	0	2	0	0	4	13
South Carolina	68	3	47	1	0	0	29	148
South Dakota	0	0	59	0	0	0	18	77
Tennessee	39	4	10	0	0	0	51	104
Texas	54	14	30	1	0	2	555	656
Utah	4	63	4	0	0	0	23	94
Vermont	6	1	0	1	1	0	5	14
Virginia	21	10	5	0	0	0	23	59
Washington	33	13	6	0	0	0	56	108
West Virginia	0	1	2	0	0	0	7	10
Wisconsin	4	15	68	0	0	0	47	134
Wyoming	14	11	6	0	0	0	31	62
Totals by Fuel:	750	732	1200	443	31	35	2423	5614

Key:

BD-Biodiesel CNG-Compressed Natural Gas
 E85-85% Ethanol ELEC-Electric
 HY-Hydrogen LNG-Liquefied Natural Gas
 LPG-Propane

Sources

U.S. Department of Energy – Alternative Fuels Data Center

<http://www.eere.energy.gov/afdc/>

White House Office of the Press Secretary

<http://www.state.gov/m/a/c8503.htm>

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<http://www.fueleconomy.gov/feg/hybridtech.shtml>

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<http://www.hybridcars.com/legislation/lawmakers-hybrid-fever.html>

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<http://e85vehicles.com/e85-stations.htm>