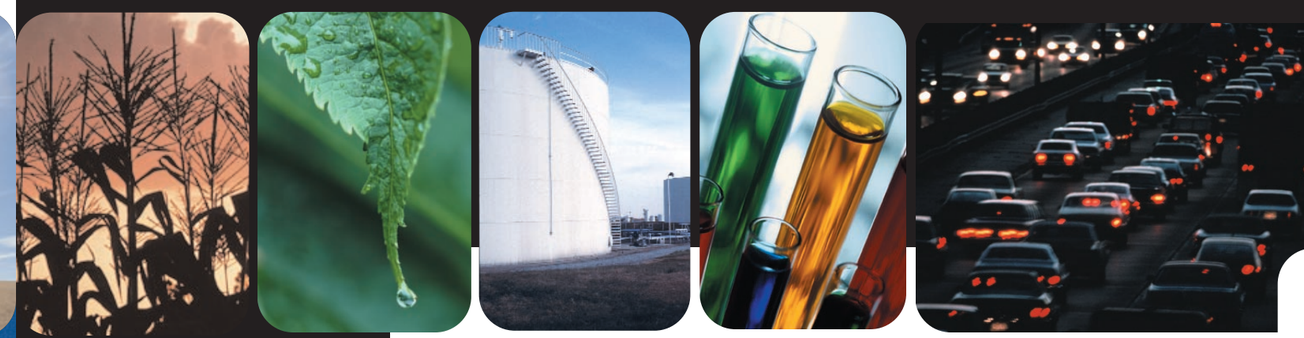
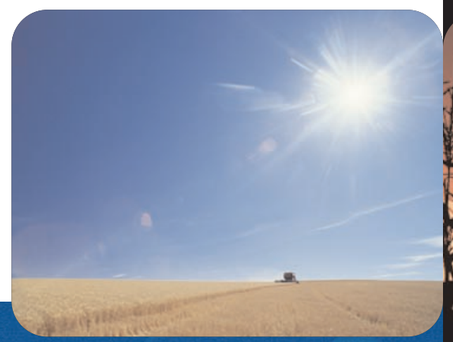
FLEXIBLE FUEL VEHICLE

F A C T B O O K

A COMPILATION OF INFORMATION ON E-85 AND THE DUAL FUEL VEHICLE INCENTIVE PROGRAM





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ABOUT THIS BOOK

"The Congress finds and declares that...the Nation's security, economic, and environmental interests require that the federal government should assist clean-burning, non-petroleum transportation fuels to reach a threshold level of commercial application and consumer acceptability at which they can successfully compete with petroleum-based fuels..." – *Alternative Motor Fuels Act of 1988*

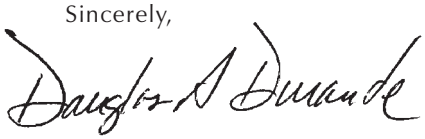
Dear Friends:

The findings of the U.S. Congress stated above are as relevant today as they were in 1988. The issues providing the impetus for the development of alternative fuels have not been resolved and, in fact, our dependence on imported oil has increased. While we have made great strides in providing our citizens with cleaner air and developing more efficient automobiles, alternative-fuel and duel fuel-vehicles have only scratched the surface in terms of the potential they offer to meet the objectives stated in the Alternative Motor Fuels Act of 1988. Incentives provided in this legislation to automobile manufacturers to provide vehicles capable of operating on alternative fuels have been extraordinarily successful. The incentive has produced the desired results with more than two million vehicles on the road today capable of operating on alternative, non-petroleum fuels.

This document is designed to provide you with an overview of the alternative-fuel vehicle incentive program, how it is working and why it needs to be maintained. America's car companies have provided a range of vehicles available to the public and America's energy companies are working to provide the alternative fuels to power them. And, these are not exotic, high tech, hard to find automobiles, but rather cars that fleet operators and everyday drivers alike can purchase. Small and mid-size pickups, mini vans, popular sedans, and family vehicles all can operate on fuels that can break us from the stranglehold imported oil has on us—while improving air quality.

We hope the information contained in this publication is helpful and please do not hesitate to contact us if we can be of assistance.

Sincerely,



Douglas A. Durante
Executive Director
Clean Fuels Development Coalition

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INTRODUCTION

In an effort to move away from using traditional petroleum products as fuels, the U.S. government has challenged automakers to come up with alternative-fuel vehicles for use on our nation's highways. The use of alternative fuels offers considerable benefits in the form of reduced dependence on foreign oil and in the reduction of vehicle emissions.

A key concern of purchasers of alternative-fuel vehicles is the lack of a refueling infrastructure. Without places to fill the vehicle with the special fuel it needs, consumers are unwilling to chance purchasing a vehicle. At the same time, without a proven demand for alternative fuels, there has been no push for the development of a refueling infrastructure for alternative fuels. This "chicken and egg" problem has long frustrated the further development of alternative-fuel vehicles.

Now, automakers have found a reliable solution. Dual-fuel vehicles are specially designed to be able to run on alternative fuels, such as grain-based ethanol, or traditional gasoline. Dual-fuel vehicles play a vital role in bridging the gap between our current gasoline-based transportation system, and a future with much less reliance on fossil fuels.

Within the last several model years, vehicle manufacturers have ramped up production of dual-fuel vehicles to the point where approximately one million of these vehicles are being driven on America's roads. The program is now working just as intended—the "chicken and egg" syndrome is being overcome.

Of course, this does not mean the program's work is done. Now that the dual-fuel vehicles are arriving on American roads in relatively large volumes, the focus must build on this success and at the same time increase efforts to improve the fueling infrastructure for alternative fuels. Clearly, the progress in developing the fueling infrastructure is lagging behind the progress in producing dual-fuel vehicles. The follow-up work on fueling infrastructure will only be carried out to its full potential if incentives put in place by the government to foster the development of dual-fuel vehicles remain in place.

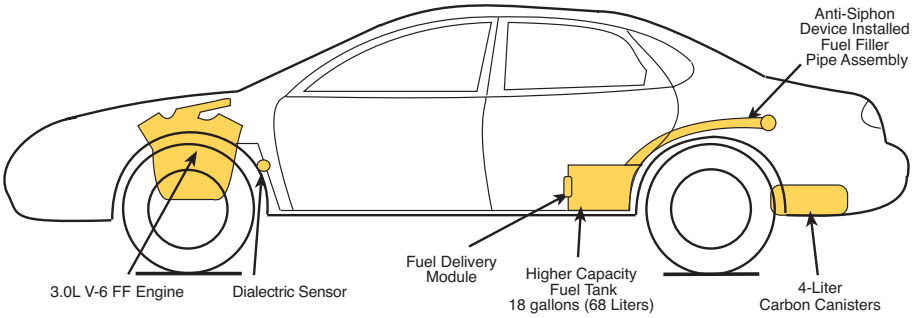
WHAT ARE ALTERNATIVE-FUEL VEHICLES?

Alternative-fuel vehicles are vehicles designed to operate on fuels other than gasoline or diesel. Alternative fuels are substantially non-petroleum and yield energy security and environmental benefits. The U.S. government currently recognizes the following as alternative fuels: methanol and denatured ethanol as alcohol fuels (alcohol mixtures that contain no less than 85% of the alcohol fuel), natural gas (compressed or liquefied), liquefied petroleum gas, hydrogen, coal-derived liquid fuels, fuels derived from biological materials, and electricity (including solar energy). The U.S. Department of Energy (DOE) has the authority to expand this list when new fuels are developed and approved as meeting this definition.

Dual-fuel vehicles, also called flexible-fuel vehicles, are designed to run on more than one fuel, such as ethanol, and standard gasoline. The idea behind the vehicles is to provide the most flexibility to the consumer.

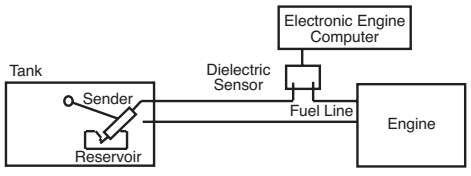
As we will discuss later in this book, the refueling infrastructure for alternative fuels is still in its infancy. Without the alternative fuel stations, consumers are leery of driving a dedicated alternative-fuel vehicle—where only an alternative fuel can be used.

Dual-fuel vehicles remove that problem by allowing operation on either alternative or conventional fuels. If E-85, for example, is available at the pump, a consumer can make the choice to use it; if it is not available, consumers aren't stranded, but can fill the tank with regular gasoline and continue on their way.



How It Works

- Fuel composition sensors monitor the fuel mixtures and the on-board computer adjusts spark timing and fuel flow to optimize performance.
- Normal oil change procedures should be followed whether the vehicle is operating on gasoline or ethanol.



Source: Ford Motor Company

WHAT ARE THE CURRENT ALTERNATIVE-FUEL VEHICLE INCENTIVES?

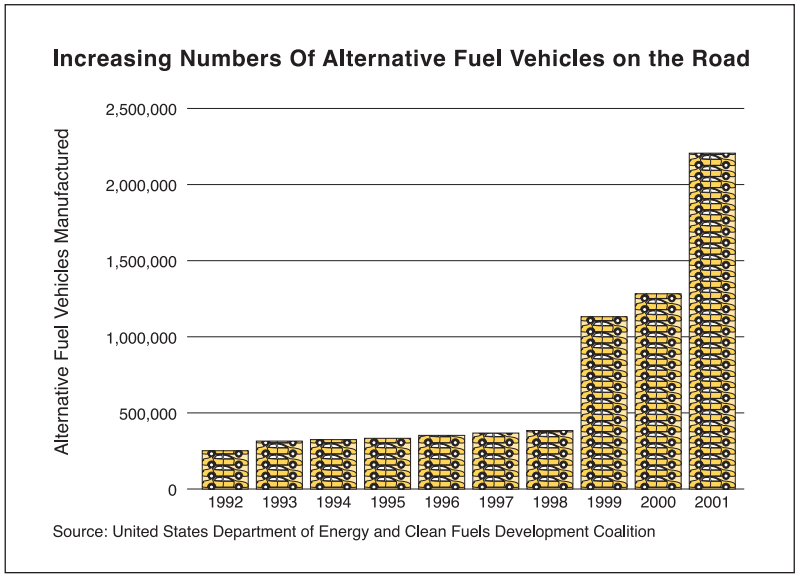
Manufacturer Incentives

The Corporate Average Fuel Economy (CAFE) law provides incentives for automobile manufacturers to manufacture both dedicated AFVs and dual-fuel vehicles. Under the provisions of the Alternative Motor Fuels Act of 1988 (AMFA), the fuel economy of dedicated AFVs and dual-fuel vehicles is calculated in such a way as to reflect the petroleum displacement possible from the purchase of these vehicles. There is a limit of 1.2 mpg on the amount of CAFE benefit that a manufacturer may derive from the production of dual-fuel vehicles.

While the CAFE credits for dedicated alternative-fuel vehicles are not limited and do not expire, under the CAFE law, the dual-fuel vehicle incentives are in place through the 2004 model year and may be extended by regulation through the 2008 model year. The Secretary of Transportation is responsible for either extending the dual-fuel CAFE incentives for up to four additional model years and explain the basis upon which the extension is granted, or publishing a notice explaining its reasons for not extending the incentives. If the Secretary does extend the incentives, the maximum CAFE increase attributable to dual-fuel vehicles drops from 1.2 mpg to 0.9 mpg for the 2005-2008 model years.

Purchase Incentives

To encourage fleet owners in purchasing alternative-fuel vehicles, the Energy Policy Act of 1992 provides tax deductions and credits to defray the increased purchase costs. For fleets in the Clean Air Act designated areas that require clean fuel fleet programs, fleet owners may earn early purchase or extra purchase credits when they purchase these vehicles.



THE CASE FOR ALTERNATIVE FUELS

So why all the push for alternative fuel use? There are basically two reasons, as outlined by the U.S. Senate when it passed the Alternative Motor Fuels Act of 1988—energy security through reduced oil imports and improving our nation's air quality through a reduction in the amount of gasoline burned.

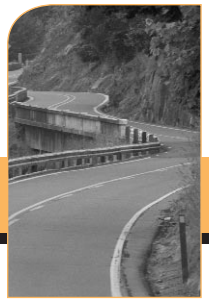
"The use of alternative fuels for automobiles would reduce America's dependence on imported oil, and might improve our current trade imbalance. Much of the transportation fuel consumed by the United States today is produced from crude oil, and a substantial part of this oil is imported.

"In addition, the use of alternative transportation fuels might reduce unhealthy emissions, since alternative fuels generally burn cleaner than gasoline, diesel and industrial fuel oil.

"The primary problem with the use of alternative fuels has been that manufacturers are reluctant to produce automobiles unless there is a demand for them, consumers will not purchase cars for which there is an inadequate fuel supply, and an adequate fuel supply is unlikely to be developed until there are a significant number of alternative-fuel vehicles.

"Consumer acceptance of vehicles powered by alternative fuels has also been cited as an obstacle to the development of such vehicles. The American public is accustomed to operating automobiles powered by gasoline, and to obtain such gasoline in a manner that permits virtually unlimited operating capability for these automobiles at any time. One solution that has been suggested to remedy this situation in the short term is to provide for the development of automobiles that are capable of operating either on gasoline, an alternative fuel, or a blend of gasoline and alternative fuel. This bill contains provisions relating to these 'dual-fuel' vehicles. These vehicles would ensure that consumers would be able to travel anywhere, since their fuel supply could be replenished either with gasoline or an alternative fuel."

Report by the Senate Commerce, Science and Transportation Committee (1988)

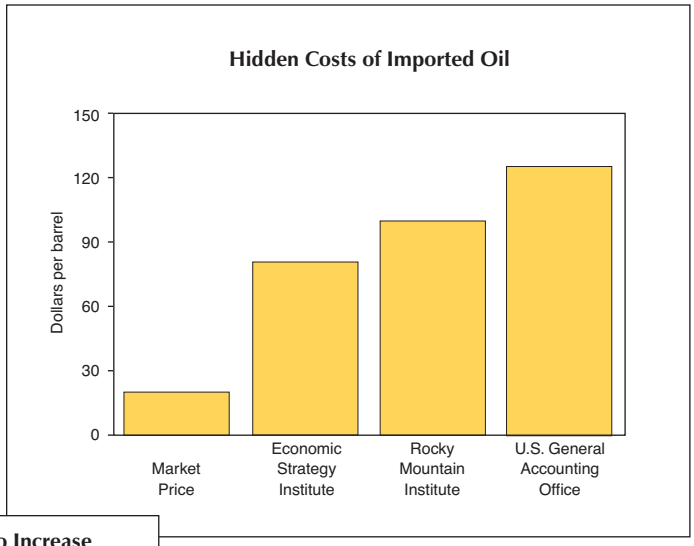


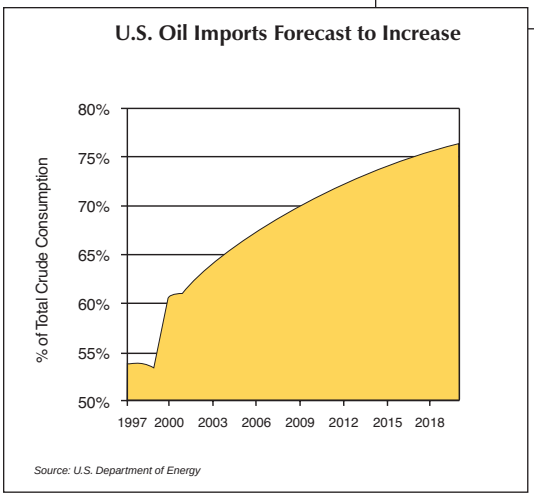
ALTERNATIVE FUELS CAN REDUCE OUR DEPENDENCE ON FOSSIL FUELS

One of the reasons cited in the original law for providing CAFE credits for AFVs is the ability of alternative fuels to reduce the U.S. dependence on fossil fuels. The rationale for these credits is just as appropriate today as it was in the original legislation.

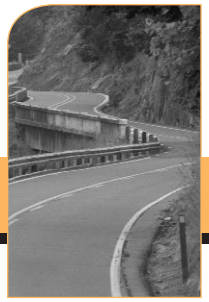
DOE's Energy Information Administration projects U.S. oil imports could grow to nearly 60-70% of total U.S. oil consumption by the year 2010 if new policies are not adopted to reverse the current trends. According to the American Petroleum Institute, the U.S. is currently dependent on foreign oil for 51.8% of its energy needs. Currently, 46.7% of the imports come from OPEC countries, with 19.1% originating from the Persian Gulf Region.

The most important way to reduce dependence on foreign oil is to increase flexibility—to increase the ability to rapidly switch to alternative, non-OPEC fuel supplies. The nation has made substantial progress in this area since the OPEC disruptions of the 1970s and the 1980s, increasing flexibility in both the consuming and producing sectors.





There are more than 25 AFV vehicle models (dedicated and dual-fuel) representing over two million vehicles on the road that can be powered by fuels other than gasoline or diesel. By operating on fuels such as natural gas, ethanol, propane, and electricity, these vehicles can displace petroleum that would otherwise be required for gasoline vehicles during oil supply disruptions. The number of AFVs on the road today is expected to grow substantially in the next few years as auto manufacturers



continue to offer high volume dual-fuel vehicles, spurred in large part by the CAFE incentives. With large sales volume of dual-fuel models just now hitting the market, the benefits of dual-fuel vehicles are about to accelerate. Without an extension of the CAFE credits for dual-fuel vehicles for another four years, this trend may prove to be short-lived.

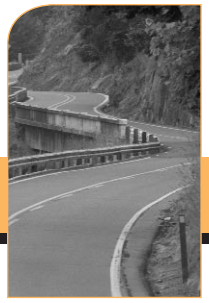
Dual-fuel vehicles have large potential for petroleum reduction when operated on the alternative fuel. Compared to gasoline vehicles, E-85 reduces petroleum use by 75%. M-85 reduces petroleum use by 73% and NG by 99% on a per mile basis using full fuel cycle analysis from the U.S. Department of Energy's Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model.

A large share of the AFVs on the road today are dual-fueled and operate on either ordinary gasoline or the alternative fuel. The amount of gasoline being displaced today is small because it has only been the last few years in which there have been big sales increases in new vehicle AFVs. Also, most of the existing dual-fueled fleet uses gasoline because of the lagging development of an alternative fuel infrastructure. With continued new, large volume AFV offerings, the growth in fueling stations, incentives for alternative fuel vehicles and fuel usage, and awareness by consumers, the amount of gasoline that can be displaced will grow.

The low alternative fuel usage of today substantially understates the contribution of dual-fuel vehicles to energy independence. The ability to withstand an OPEC disruption depends not on the level of oil use at any one point in time, but rather the ability to reduce that level over an interval of time. This is important because the existing dual-fuel vehicles on the road provide the capability to operate on the alternative fuel. In times of an oil crisis or the need to reduce oil usage, these vehicles have the capability to run on the alternative fuel 100% of the time. This flexibility could provide critical relief in the event of an energy crisis.

Dual-fuel capability also provides a needed transition to vehicles that run solely on the alternative fuel. Until the infrastructure catches up, these dual-fuel vehicles provide the bridge to dedicated vehicles. Today's dual-fuel vehicles help to solve the chicken-or-egg issue that faces the manufacturers of vehicles and the manufacturers of the fueling stations, as well as consumers.

Finally, alternative fuels offer a further advantage in addressing U.S. dependence on foreign oil by further increasing the fuel switching ability on the supply side. That is because alternative fuels can be produced from a wide variety of feedstocks to produce the fuels. These feedstocks vary from corn to natural gas to biomass, all of which are indigenous to the U.S. For example, ethanol is produced primarily from corn today, but technology is developing to make it from herbaceous and woody biomass.



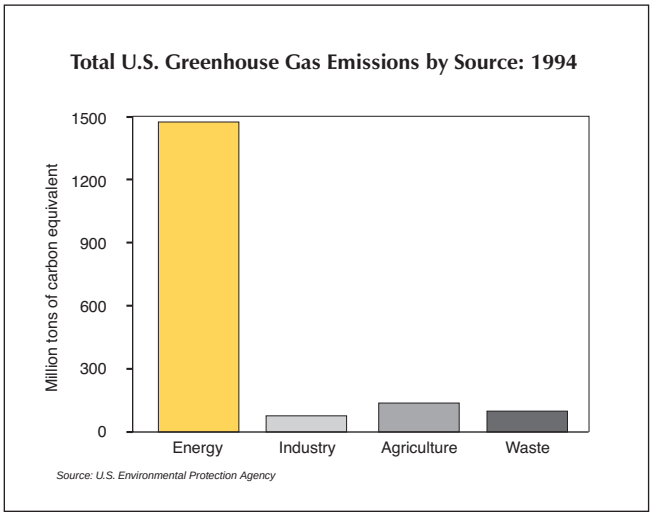
VARIOUS ALTERNATIVE FUELS AND THEIR GREENHOUSE GAS EMISSIONS

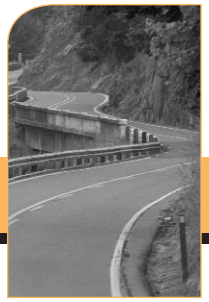
Automobile manufacturers are working hard to reduce the impact of driving on the environment. In addition to the significant improvements in vehicle emissions that have already been made, this ongoing endeavor can be witnessed with the continued introduction of newer advanced technologies into the market. One of the most viable near-term solutions to reduce CO_2 emissions is the alternative fuel vehicle operated on renewable fuels.

The 1990 Intergovernmental Panel on Climate Change (IPCC) report states that the use of alternative fuels has potential to reduce Greenhouse Gas (GHG) emissions from vehicle operation by 80% or more compared to current gasoline vehicles. These analyses all argue for the continued support for developing both alternative fuels and vehicles that can run on them.

The U.S. Department of Energy's Argonne National Laboratory has developed the GREET model to estimate full fuel cycle (production, distribution and use of the fuel) energy use and emissions associated with alternative transportation fuels and advanced vehicle technologies. This model evaluates the advantages of these alternative fuels.

Renewable E-85 demonstrates substantial reductions in full fuel cycle greenhouse gas emissions compared to gasoline. There are a wide variety of feedstocks (herbaceous biomass, woody biomass, and corn) to produce E-85, making a significant difference in full fuel cycle GHG emissions.



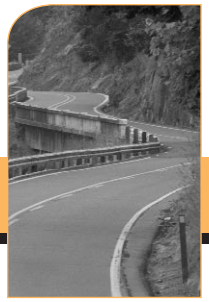


ENVIRONMENTAL/AIR QUALITY BENEFITS OF ALTERNATIVE FUELS

The use of alternative fuels offers benefits in the reduction of vehicle emissions. Further, the use of alternative fuels, especially those made from renewable sources, can lead to reduced greenhouse gas emissions and aid in the accomplishment of other environmental goals.

Alternative fuels are inherently cleaner than gasoline because they are chemically less complex than gasoline and when burned, they burn "cleaner" with fewer ozone forming emissions. In addition, certain alternative fuel vehicles, such as those fueled with natural gas, have almost no evaporative emissions due to closed fuel systems.

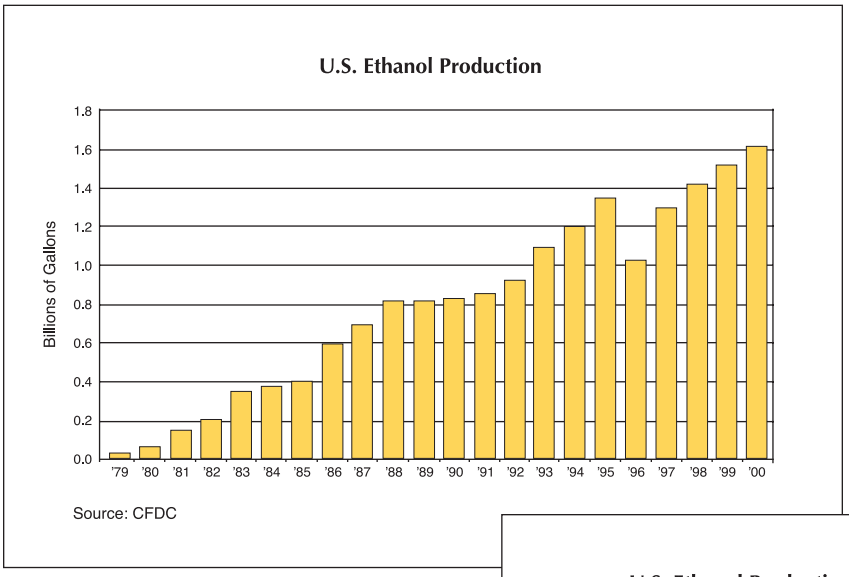
New more stringent emission requirements such as Tier 2 and LEV II which begin to phase-in beginning in 2004 will eliminate most of the tailpipe and evaporative emissions advantage of alternative fuels. However, alternative fuels will continue to provide emission benefits in the in-use fleet for many years and renewable fuels will be needed to address greenhouse gas emission concerns.

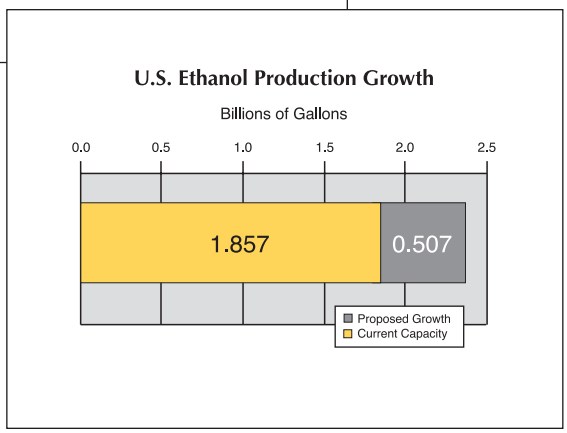


ABUNDANT SUPPLIES OF ALTERNATIVE FUEL SOURCES

In addition to the standard ethanol production process that derives fuel-grade ethanol from grains, a great deal of work is underway to make ethanol cost-effectively from cellulose, garbage or other waste material. Such a development would make ethanol production possible virtually everywhere in the nation.

Of all the alternative fuels currently in use, renewable ethanol is one of the most advanced in terms of fuel and vehicle availability. Over the past two decades, fuel ethanol production, primarily from corn and other agricultural crops, has increased dramatically. At the same time, automakers have built millions of vehicles capable of operating on this renewable, alternative fuel.





THE CASE FOR EXTENSION OF CAFE INCENTIVES

A recent report published by the U.S General Accounting Office ("Limited Progress in Acquiring Alternative Fuel Vehicles and Reaching Fuel Goals," February 2000) which highlights the progress of the 1992 Energy Policy Act (EPACT), agrees that the dual-fuel Corporate Average Fuel Economy (CAFE) incentives have significantly increased the number of alternative-fuel-capable vehicles. It also said, however, that the goals of the EPACT are not being met principally because customer-accessible refueling stations are not widely available. The relatively low price of gasoline, the lack of refueling stations for alternative fuels, and in some cases, the additional cost to purchase these vehicles, explain much of why both mandated fleets and the general public are not inclined to acquire AFVs and use the alternative fuels.

The dual-fuel CAFE credits were provided as incentives to manufacturers to introduce dual-fuel vehicles (there are approximately one million dual-fuel vehicles on American roads today). However, the dual-fuel CAFE incentives are still needed to continue the high-volume production of these vehicles and to encourage an improved alternative fuel infrastructure to accomplish the ultimate goal of the AMFA. As more vehicles are delivered, we believe that the infrastructure to support these vehicles will also increase, providing the necessary infrastructure for dedicated vehicles.

The dual-fuel CAFE incentives have encouraged the technology development and production of vehicles capable of running on non-petroleum fuels. Time was required to develop, test and introduce the technology into the marketplace with expected performance and reliability. In the last few years, manufacturers have produced and made available to retail customers an increasing number of dual-fuel vehicles. Dual-fuel vehicles are helping bridge the gap between fleet customers, with dedicated refueling infrastructure, and retail customers.

Facts For The Record

The GAO found "remarkable consistency in the experiences and lessons reported" from alternative fuel programs in other parts of the world. Among those findings were that "industry needs to have reasonable prospects for a favorable economic return," and that "Government needs to be the catalyst for encouraging consumers' use of and industry's involvement in alternative fuels by providing leadership and a consistent commitment." – *General Accounting Office, RCED-00-59, Feb. 2000*

With the extension of CAFE incentives for dual-fuel vehicles, manufacturers will continue to have incentives to produce these vehicles irrespective of the hurdles pointed out in the GAO study. In time, a critical mass of vehicles will be on the road that will provide additional incentives to further extend the infrastructure. With ever increasing production volumes, easier to find and access refueling stations, and acceptance by the general public, the U.S will begin to approach the goals set out by AMFA and EPACT. Conversely, in the absence of CAFE credits, and given the engineering resources necessary to develop dual-fuel vehicles, there will exist disincentives to continuing the high-volume production of such vehicles.

Recent high gasoline prices have sparked interest for alternative fuel and dual-fuel vehicles. Once the public sees that a choice of fuels is available, without compromising reliability, performance or function—and that they provide additional environmental benefit at a zero or minimal premium in price—then alternative fuels will become more accepted. In addition, as large volumes of alternative fuels are produced, the price differential between the fuel and gasoline may decrease, making the alternative fuel more desirable. However, it is crucial that both volumes of vehicles as well as refueling stations increase to make the transition toward greater use of alternative fuels.

The development of alternative fuels in the U.S. is not a new concept. In fact, the federal government has been looking at the issue of alternative fuels for more than two decades. Each time the government has studied the issue, it reaches the same conclusion—the growth of an AFV industry in this country depends on strong policy support from the federal government.

The U.S. government has tried to meet the challenge of boosting industry growth through legislation. In 1991, the U.S. General Accounting Office analyzed the experiences of other countries using alternative fuels with respect to increasing the federal procurement of such vehicles. In that report (GAO/RCED-91-169, May 1991), they examined the practices of Brazil, Canada and New Zealand—all of which had some success with alternative fuels, and found that a commitment from the government is critical to the success of such a program.

Executive Orders 12759 and 12844:
Two Presidential orders, which establish requirements for federal agencies to purchase AFVs. Order 12844 accelerates agency acquisitions by 50% beyond requirements contained in Section 303 of the Energy Policy Act for fiscal years 1993-1995, subject to the availability of funds.

ALTERNATIVE MOTOR FUELS ACT OF 1988

In the late 1980s, Congress was determined to reduce the United States' reliance on gasoline-powered vehicles in order to reduce our dependence on foreign oil. However, a number of obstacles needed to be overcome in order to achieve this objective. Consumers, who are very accustomed to the convenience and features on today's gasoline-powered vehicles, needed to be convinced to switch to vehicles powered by a different fuel. Fuel providers needed to create the infrastructure necessary to permit widespread use of vehicles powered by alternative fuel so that refueling would be convenient. And finally, automobile manufacturers needed to be persuaded to produce alternative fuel vehicles in large numbers in the absence of consumer demand. The dominance of gasoline-powered vehicles and the existence of this "chicken and egg" problem meant that only a fraction of motor vehicles were capable of operating on any fuel other than gasoline.

Congress broke through this "chicken and egg" problem with the passage of the Alternative Motor Fuels Act of 1988. The law is designed to encourage the development of vehicles that use methanol, ethanol, and natural gas as transportation fuels and the widespread use of the vehicles and fuels by consumers.

The Act created a program of modest financial support for research, development, and demonstration on both vehicles and fuels, plus the very important fuel economy credits for automobile manufacturers under CAFE.

The law provided that:

- *The federal government must purchase as many passenger automobiles and light duty trucks powered by alcohol or natural gas as is practical.*
- *Manufacturers would receive Corporate Average Fuel Economy credits for both dedicated alternative-fuel and dual-fuel vehicles. The Department of Transportation must review the success of the dual-fuel CAFE credits and decide whether to extend those credits.*

CLEAN AIR ACT AMENDMENTS OF 1990

In 1990, the Clean Air Act was substantially amended to address a broad spectrum of air quality issues. Among the provisions was the Clean Fuel Fleet Program, a requirement for certain fleet operators to use clean fuel vehicles in 22 metropolitan areas nationwide. The clean fuels included reformulated gasoline and alternative fuels, including natural gas, LPG, alcohols, and electricity.

The Clean Air Act Amendments also established the California Pilot Program requiring 150,000 clean fuel vehicles a year for California by 1996, increasing to 300,000 a year by 1999.

ENERGY POLICY ACT OF 1992

The goal of the Energy Policy Act of 1992 (EPACT) is to reduce the country's reliance on petroleum fuels and reach a national target of 30% penetration of non-petroleum fuels by 2010. The Act requires that the federal government, alternative fuel providers, state and local governments, and private fleets buy alternative fuel vehicles in percentages which increase over time. The Act broadened the definition of alternative fuels to include hydrogen, coal-derived liquid fuels, and fuels derived from biological materials.

The EPACT was also the genesis of the federal Clean Cities Program. This is a voluntary federal program designed to accelerate and expand the use of alternative fuel vehicles and to provide refueling and maintenance facilities for their operation. More than 40 major cities are part of this program.

The Act also creates tax incentives for vehicle buyers and for alternative fuel service station operators.

REQUIRED PURCHASES UNDER EPACT

	Percentage of all acquisitions for groups mandated to acquire vehicles		
Year	**Federal Agencies**	**State Governments**	**Alternative Fuel Providers**
1996	25	N/A	N/A
1997	33	10	30
1998	50	15	50
1999	75	25	70
2000	75	50	90
2001 and beyond	75	75	90

Note: The act mandated that the federal government had to acquire 5,000 alternative fuel vehicles in 1993, 7,500 vehicles in 1994 and 10,000 vehicles in 1995. It did not require state governments and alternative fuel providers to acquire alternative fuel vehicles during these years. In addition, the states' and fuel providers' acquisition mandates for 1996 were postponed for one year.

Source: *Energy Policy Act 1992 and DOE.*

CONTINUED POLITICAL SUPPORT FOR AFVs

A policy goal of nearly every administration from President Ford to President George W. Bush has been to reduce the dependence of the U.S. on foreign oil. The reasons for this include energy security, balance of payments considerations, and, of course, protecting the U.S. consumer from the price fluctuations based upon OPEC production decisions.

With support from the current administration, and the previous presidents, it is clear that the earliest possible extension of the credits would be in the nation's interest, and consistent with administration policy. Extending the credit would show a clear signal to manufacturers that future investments in alternative fuel technology will be rewarded.

Quotes For The Record

"...I think it's important for our long-term security [to] get America in a position where...our ability to use alternative-fuel vehicles, or dual-use vehicles, biofuels, mixed electric and gasoline-fuel vehicles...that our capacity to do that is so great that we will not be reliant on the ups and downs of supplies, and the increases that might come in the future would have a much more limited impact on us." — *President Bill Clinton, February 16, 2000*

"Our policy will modernize, and increase conservation by ensuring that energy is used as efficiently as possible. In addition, the National Energy Policy will modernize and expand our energy infrastructure, creating a new high-tech energy delivery network that increases the reliability of our energy supply. Further, it will diversify our energy supply by encouraging renewable and alternative sources of energy as well as the latest technologies to increase environmentally friendly exploration and production of domestic energy resources." — *President George W. Bush, June 28, 2001*

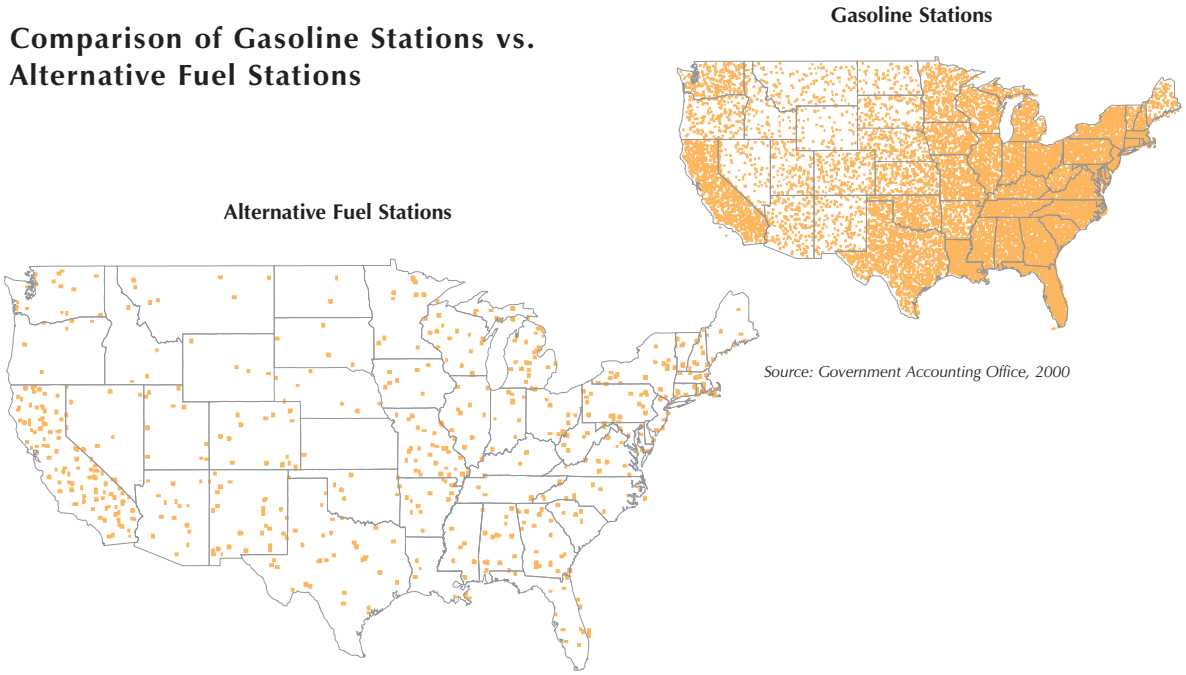
Major automobile manufacturers in the U.S. have produced two million alternative fuel vehicles since 1990. A combination of industry efforts and the growing number of alternative-fuel and dual-fuel vehicles on the road has encouraged an increase in the number of refueling sites. Though the number of refueling sites has increased, significant work needs to be done to increase the alternative fuel infrastructure to a point where mobility on alternative fuels throughout the U.S. is feasible. For the alternative fuel program to be successful, alternative fuels must be as available and accessible to the consumer as gasoline.

Significant progress is still needed for drivers of AFVs to have the mobility they enjoy with conventional gasoline vehicles. This can be accomplished through continued high volume production of dual-fuel vehicles and incentives to encourage the alternative fuel use.

PROGRESS ON THE CURRENT AFV INFRASTRUCTURE:

To be truly successful, the refueling infrastructure for alternative fuels must be expanded. Compared to the number of gasoline refueling stations, the infrastructure for alternative fuels is still in its infancy, as noted below.

Comparison of Gasoline Stations vs. Alternative Fuel Stations



Source: Government Accounting Office, 2000

Source: Energy Information Administration

Note: Each dot represents 10 refueling stations in the state, rounded up to the next highest 10 (e.g., a state with 11 stations would receive 2 dots). The dots in each state do not correspond to the geographic location of stations in the state.

INFRASTRUCTURE STATUS

Electric Vehicles

Most homes and business have outlets, but special hookups or upgrades may be required.

Public charging networks are developing in California and other states, with almost 600 sites in operation.

Ethanol

Fueling station availability is currently sparse — approximately 130, primarily in the upper Midwest.

Methanol

Fueling stations are currently sparse — only 2 in the U.S.

M-100 is available through bulk suppliers in most major cities.

Natural Gas

Fueling stations are located in most major cities and in many rural areas, with approximately 1,200 stations nationwide.

Opportunity to refill at home.

LNG is only available through suppliers of cryogenic fuels.

Propane

Publicly accessible fueling stations exist in all states with approximately 3,300 stations nationwide.

SOURCE OF ALTERNATIVE FUELS

Ethanol

FUEL DESCRIPTION

- *Liquid produced from grain or agricultural waste.*
- *E-85 (blend of 85% denatured ethanol and 15% gasoline) is for light-duty applications, while E-95 (blend of 95% denatured ethanol and 5% gasoline) is for heavy-duty applications.*

DOMESTIC CONTENT OF FUEL

- *Currently as high as 100% for pure ethanol, depending on world market price.*

Methanol

FUEL DESCRIPTION

- *Odorless clear liquid, produced from natural gas, coal, or biomass.*
- *M-85 (blend of 85% methanol and 15% gasoline) is for light-duty applications.*
- *M-100 (pure methanol) is for heavy-duty applications now; light-duty applications are under development.*

DOMESTIC CONTENT OF FUEL

- *As high as 100%; generally at least 90%, depending on world market price.*

Natural Gas

FUEL DESCRIPTION

- *Natural gas is one of the world's leading alternative engine fuels that has been in use since the 1930s.*
- *Extracted from underground reserves, composed primarily of methane.*
- *For gaseous vehicle fuel (CNG), gas is compressed to 2,400-3,600 pounds per square inch in specially designed and constructed cylinders. For liquefied vehicle fuel (LNG), gas is cooled to minus 259°F and stored in insulated tanks.*

DOMESTIC CONTENT OF FUEL

- *100%.*

Propane

FUEL DESCRIPTION

- *Also known as Liquefied Petroleum Gas (LPG), propane has been used as a vehicle fuel for over 60 years.*
- *It is stored as a liquid, but can be delivered to the engine as a gas or liquid.*
- *Propane is a liquid mixture (at least 90% propane, 2.5% butane and higher hydrocarbons, and the balance ethane and propylene). It is a by-product of natural gas processing or petroleum refining.*

DOMESTIC CONTENT OF FUEL

- *Between 95% and 98%.*

Electricity

FUEL DESCRIPTION

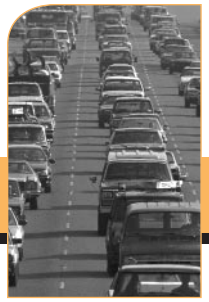
- *Onboard rechargeable batteries power an electric motor.*

DOMESTIC CONTENT OF FUEL

- *Over 95%, based on current mix of input energy (coal, natural gas, nuclear, hydropower, renewables) for electric-power generation.*

MODEL YEAR 2001: Alternative Fuel Vehicles and Advanced Technology Vehicles Available or Nearing Completion

Fuel Type	Model	Vehicle Type	Emission Class	Power-Train	[2]Fuel Capacity	[3]Range
American Honda Motor Corporation		**888-CCHONDA • www.honda.com**				
CNG Dedicated	Civic GX	Sedan	ILEV ULEV, SULEV	1.7L, 4-cylinder	8GCE	220-245 mi
Electric (NiMH)	[4]Insight	Two Seater	LEV (CA ULEV)	1.0L, 3-cylinder VTEC engine with Intergrated Motor Assist System (144 volt NiHM)	(NiMH) battery +10.6 Gal Gasoline	600-700 mi
DaimlerChrysler		**800-999-FLEET • www.fleet.chrysler.com**				
CNG Dedicated	Dodge Ram Van, Dodge Ram Maxi Van, Dodge Ram Wagon, Dodge Ram Maxi Wagon	Van, Wagon	ILEV, ULEV (CA SULEV)	5.2L V8	18.7 GCE	200-300 mi
E-85 FFV	[1]Chrysler Town and Country, [1]Dodge Caravan, [1]Dodge Grand Caravan, [1]Chrysler Voyager, [1]Grand Voyager	Minivan	LEV	3.3L V6	20 GCE	TBD
Ford Motor Company		**877-ALTFUEL • www.fleet.ford.com**				
CNG Dedicated	Ford E-Series Cutaway	Passenger Van	ULEV	5.4L V8	19.2 GCE (does not include extended range tank options	148-238 mi
CNG Dedicated	F-150	Light-Duty Pickup	ILEV, SULEV CA SULEV	5.4L V8	18.8 or 21.6 GCE	200-300 mi
CNG Dedicated	Econoline	Van	ILEV, SULEV CA SULEV	5.4L V8	18.8 or 21.6 GCE	150-275 mi
CNG Bi-Fuel	F-150	Light-Duty	ULEV	5.4L V8	12.5 GCE	100-175 mi
CNG Dedicated	Crown Victoria	Sedan	ULEV	4.6L V8	9.4 GCE 14.8 with extended tank option	100-175 mi optional tank range 200-300 mi
E-85 FFV	[1]Taurus	Sedan	ULEV	3.0L V6	18 GCE	250-350 mi
E-85 FFV	[1]Explorer Sport	SUV	TBD	4.0 OHV V6	TBD	210-320 mi
E-85 FFV	[1]Ranger FFV	Light-Duty Pickup	LEV	3.0L V6	12.2 GCE	160 mi
Electric (Lead Acid)	Ranger EV (Lead Acid)	Light-Duty Pickup	ZEV	3-phase AC motor	23kWh	73 mi
LPG Bi-Fuel	F-150	Light-Duty Pickup	ULEV	5.4L V8	26.2 GCE	300-400 mi
LPG Bi-Fuel	F-Series Super Duty	Medium-Duty Truck	ULEV	6.8L V10	21 or 28 GCE Propane Tank + 19 Gallon Gas Tank	TBD
General Motors Corporation		**888-GM-AFT-4U • www.gmaltfuel.com**				
CNG Bi-Fuel	Chevrolet Express GMC Savana	Cargo or Passenger Van	LEV	5.7L V8	31/9.3 GCE @3600 PSI	TBD
CNG Bi-Fuel	Chevrolet Cavalier 1.5 Gallon Gasoline	Sub-compact	LEV	2.2L V4	6.2 GCE CNG +	TBD
E85 FFV	[1]Chevrolet S-10 GMC Sonoma	Light-Duty Pickup	LEV	2.2L V4	18.5 GCE	400 mi



MODEL YEAR 2001: Alternative Fuel Vehicles and Advanced Technology Vehicles Available or Nearing Completion

Fuel Type	Model	Vehicle Type	Emission Class	Power-Train	[2]Fuel Capacity	[3]Range
General Motors Corporation		**888-GM-AFT-4U • www.gmaltfuel.com**				
Electric (Lead Acid)	EV-1 (CA, AZ only)	Two Seater	ZEV	3 phase AC induction	18.7 kWh	55-95 mi
Electric (NiMH)	EV-1 (CA, AZ only)	Two Seater	ZEV	3 phase AC induction	26.4 kWh	75-130 mi
LPG Dedicated	Chevrolet/GM Medium Duty Truck	Medium-Duty Truck	LEV	8.1L V8	TBD	TBD
Mazda USA		**800-222-5500 • www.mazdausa.com**				
E-85 FFV	[1]B3000	Light-Duty Pickup	LEV	3.0L V6	19.6 GCE	230-300 mi
Nissan North America		**800-NISSAN1 • www.nissandriven.com/menu_nf.html**				
Electric (Lithium-Ion)	Altra-EV (select fleets in CA)	Mid-size Wagon	ZEV	62 kW AC induction	TBD	80 mi
Electric (Lithium-Ion)	Hypermini (select fleets in CA)	Two-Seater	ZEV	TBD	TBD	40 mi
Solectria Corporation		**978-658-2231 • www.solectria.com**				
Electric (Lead Acid)	Citivan	Service Van	ZEV	70kW AC induction	52 modules (sealed PbA)	40 mi
Electric (Lead Acid)	Flash	Small Pick-up	ZEV	34kW AC induction	12, 12-volt modules	60 mi
Electric (PbA, NiMH, (NiCd)	Force	Compact	ZEV	42kW AC induction	12, 13-volt modules (PbA)	50-80 mi PbA, 85-136 mi NiCd, NiMH
Toyota Motor Sales, USA, Inc.		**800-GO-TOYOTA • www.toyota.com**				
CNG Dedicated	CNG Camry (fleet customers only)	Compact	ULEV	2.2 liter, 16 valve, 4-cylinder	11.4 GCE	270 mi
Electric (PbA or NiMH)	RAV-4EV (fleet customers only)	Small SUV	ZEV	50kW	24, 12-volt modules (NiMH)	125 mi
Hybrid EV	Prius	Compact	SULEV	1.5 DOHC 16-valve EFI 4 cylinder/VVT-1	40 modules NiHM + 11.8 Gasoline	570 mi

[1] All E-85 vehicles are considered flexible-fueled vehicles (FFVs).
[2] CNG and LPG vehicles fuel capacity based on slow fill @ 3600 psi.
[3] Estimated range on alternative fuel and based on fuel capacity. For EVs, range depends on battery type.
[4] The Insight and Prius are considered advanced technology vehicles, not AFVs.

Glossary of Abbreviations

AC	Alternate Current	LPG	Liquefied Petroleum Gas (propane)
CA	California	Mi	Miles
CNG	Compressed Natural Gas	NiCd	Nickel Cadmium
E85	85% Ethanol, 15% Gasoline	NiMH	Nickel Metal Hydride
EV	Electric Vehicle	PbA	Lead Acid
FFV	Flexible Fuel Vehicle	SULEV	Super Ultra Low Emission Vehicle
Gal	US Gallon	SUV	Sport Utility Vehicle
GCE	Gasoline Gallon Equivalent	TBD	To Be Determined
ILEV	Inherently Low Emission Vehicle	TLEV	Transitionally Low Emission Vehicle
kW	Kilowatts	ULEV	Ultra Low Emission Vehicle
L	Liter	ZEV	Zero Emission Vehicle

Other Websites

Alternative Fuel Vehicle Fleet Buyers Guide
www.fleets.doe.gov

Alternative Fuels Data Center
www.afdc.doe.gov

Office of Transportation Technologies
www.ott.doe.gov

Source

The Alliance of Automobile Manufacturers, Inc.

FOR MORE INFORMATION CONTACT:

The Alliance of Automobile Manufacturers, Inc.
1401 H Street, N.W.
Suite 900
Washington, DC 20005
(202) 326-5500
www.autoalliance.org

Clean Fuels Development Coalition
1925 North Lynn Street
Suite 724
Arlington, VA 22209
(703) 276-CFDC (2332)
www.CleanFuelsDC.org

National Ethanol Vehicle Coalition
3118 Emerald Lane
Suite 100
Jefferson City, MO 65109
(573) 635-8445
www.E85Fuel.com

Nebraska Ethanol Board
301 Centennial Mall South
P.O. Box 94922
Lincoln, NE 68509 USA
Phone: (402)471-2941
www.NE-Ethanol.org

United States Department of Energy
Alternative Fuels Hotline
(800) 423-1363
www.afdc.doe.gov

GLOSSARY

Air Toxics: Toxic air pollutants defined under Title II of the CAA, including benzene, formaldehyde, acetaldehyde, 1-3 butadiene and polycyclic organic matter (POM). Benzene is a constituent of the fuel. The other compounds are exhaust pollutants.

Alcohols: Organic compounds that are distinguished from hydrocarbons by the inclusion of a hydroxyl group. The two simplest alcohols are methanol and ethanol.

Alternative Fuel: As defined pursuant to the EPACT, methanol, denatured ethanol and other alcohols, separately or in mixtures of 85% by volume or more with gasoline or other fuels, CNG, LNG, LPG, hydrogen, "coal-derived liquid fuels," fuels "other than alcohols" derived from "biological materials," electricity, neat biodiesel, or any other fuel determined to be "substantially not petroleum" and yielding "substantial energy security benefits and substantial environmental benefits."

Alternative-Fuel Provider: A fuel provider (or any affiliate or business unit under its control) is an alternative-fuel provider if its principal business is producing, storing, refining, processing, transporting, distributing, importing or selling (at wholesale or retail) any alternative fuel (other than electricity); or generating, transmitting, importing or selling (at wholesale and retail) electricity; or if that fuel provider produces, imports, or produces and imports (in combination), an average of 50,000 barrels per day of petroleum and 30% (a substantial portion) or more of its gross annual revenues are derived from producing alternative fuels.

Alternative-Fuel Vehicle (AFV): As defined by the Energy Policy Act, any dedicated, flexible-fueled, or dual-fueled vehicle designed to operate on at least one alternative fuel.

Alternative Motor Fuels Act of 1988 (AMFA): Public Law 100-494. Encourages the development, production and demonstration of alternative motor fuels and AFVs.

GLOSSARY

Anhydrous: Describes a compound that does not contain any water. Ethanol produced for fuel use is often referred to as anhydrous ethanol, as it has had almost all water removed.

Aromatics: Hydrocarbons based on the ringed six-carbon benzene series or related organic groups. Benzene, toluene and xylene are the principal aromatics, commonly referred to as the BTX group. They represent one of the heaviest fractions in gasoline.

Benzene: A six-carbon aromatic; common gasoline component identified as being toxic. Benzene is a known carcinogen.

Bi-fuel Vehicle: A vehicle with two separate fuel systems designed to run on either an alternative fuel, or gasoline or diesel, using only one fuel at a time. Bi-fuel vehicles are referred to as "dual-fuel" vehicles in the CAA and EPACT.

Biodiesel: A biodegradable transportation fuel for use in diesel engines that is produced through transesterification of organically derived oils or fats. Biodiesel is used as a component of diesel fuel. In the future it may be used as a replacement for diesel.

Biomass: Renewable organic matter such as agricultural crops, crop-waste residues, wood, animal and municipal wastes, aquatic plants, fungal growth, etc., used for the production of energy.

British Thermal Unit (Btu): A standard unit for measuring heat energy. One Btu represents the amount of heat required to raise one pound of water one degree Fahrenheit (at sea level).

Butane: A gas, easily liquefied, recovered from natural gas. Used as a low-volatility component of motor gasoline, processed further for a high-octane gasoline component, used in LPG for domestic and industrial applications and used as a raw material for petrochemical synthesis.

BTX: Industry term referring to the group of aromatic hydrocarbons benzene, toluene and xylene (see Aromatics).

Carbon Dioxide (CO_2): A product of combustion that has become an environmental concern in recent years. CO_2 does not directly impair human health but is a "greenhouse gas" that traps the earth's heat and contributes to the potential for global warming.

Carbon Monoxide (CO): A colorless, odorless gas produced by the incomplete combustion of fuels with a limited oxygen supply, as in automobile engines. CO is poisonous if inhaled, entering the bloodstream through the lungs and forming carboxyhemoglobin, a compound that inhibits the blood's capacity to carry oxygen to organs and tissues. CO can impair exercise capacity, visual perception, manual dexterity and learning functions.

Carbon Sequestration: The absorption and storage of CO_2 from the atmosphere by the roots and leaves of plants; the carbon builds up as organic matter in the soil.

Carcinogens: Chemicals and other substances known to cause cancer.

Catalyst: A substance whose presence changes the rate of chemical reaction without itself undergoing permanent change in its composition. Catalysts may be accelerators or retarders. Most inorganic catalysts are powdered metals and metal oxides, chiefly used in the petroleum, vehicle and heavy chemical industries.

Cetane: Ignition performance rating of diesel fuel. Diesel equivalent to gasoline octane.

Clean Air Act (CAA): The original Clean Air Act was signed in 1963. The law set emissions standards for stationary sources (e.g., factories, power plants). The CAA was amended several times, most recently in 1990 (P.L. 101-549). The Amendments of 1970 introduced motor vehicle emission standards (e.g., automobiles, trucks). Criteria pollutants included lead, ozone, CO, SO_2, NOx and PM, as well as air toxics. In 1990, reformulated gasoline (RFG) and oxygenated gasoline provisions were added. The RFG provision requires use of RFG all year in certain areas. The oxygenated gasoline provision requires the use of oxygenated gasoline during certain months, when CO and ozone pollution are most serious. The regulations also require certain fleet operators to use clean-fuel vehicles in 22 cities.

Clean-Fuel Vehicle (CFV): Any vehicle certified by EPA as meeting certain federal emissions standards. The three categories of federal CFV standards from least to most stringent are LEV, ULEV, and ZEV. The ILEV standard is voluntary and does not need to be adopted by states as part of the Clean-Fuel Fleet Program. CFVs are eligible for two federal programs, the California Pilot Program and the Clean-Fuel Fleet Program. CFV exhaust emissions standards for light-duty vehicles and light-duty trucks are numerically similar to those of CARB's California Low-Emission Vehicle Program.

Compressed Natural Gas (CNG): Natural gas that has been compressed under high pressures, typically between 2000 and 3600 psi, held in a container. The gas expands when released for use as a fuel.

Corporate Average Fuel Economy (CAFE): (P.L. 94-163) Law passed in 1975 that set federal fuel economy standards. The CAFE values are an average of city and highway fuel economy test results weighted by a manufacturer for either its car or truck fleet.

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Dedicated Alternative-Fuel Vehicle: Operates solely on one alternative fuel. Generally, dedicated vehicles provide superior emissions and performance results because their design has been optimized for operation on only one fuel.

Denatured Alcohol: Ethanol that contains a small amount of a toxic substance, such as methanol or gasoline, which cannot be removed easily by chemical or physical means. Alcohols intended for industrial use must be denatured to avoid federal alcoholic beverage tax.

Domestic Fuel: As defined by the Energy Policy Act, Section 301, domestic fuel is derived from resources within the United States, its possessions and commonwealths, and Canada and Mexico (the two nations in a free-trade agreement with the U.S.).

Dual-Fuel Vehicle:
EPACT Definition: Vehicle designed to operate on a combination of an alternative fuel and a conventional fuel. This includes: a) vehicles using a mixture of gasoline or diesel and an alternative fuel in one fuel tank, commonly called flexible-fueled vehicles; and b) vehicles capable of operating either on an alternative fuel, a conventional fuel or both, simultaneously using two fuel systems commonly called bi-fuel vehicles.

CAA Definition: Vehicle with two separate fuel systems designed to run on either an alternative fuel or conventional gasoline, using only one fuel at a time.

E-85: Ethanol/gasoline mixture containing 85% denatured ethanol and 15% gasoline, by volume. This fuel is different from E-10 (gasohol) which is an ethanol/gasoline mixture containing 10% denatured ethanol and 90% gasoline, by volume.

Electricity: Electric current used as a power source. Electricity can be generated from a variety of feedstocks including oil, coal, nuclear, hydro, natural gas, wind, and solar. In electric vehicles, onboard rechargeable batteries power an electric motor.

Electric Vehicle: A vehicle powered by electricity, generally provided by storage batteries, but also provided by photovoltaic cells or a fuel cell.

Energy Policy Act of 1992 (EPACT): (P.L. 102-486) A broad-ranging act signed into law on Oct. 24, 1992. Titles III, IV, V, XV and XIX of EPACT deal with alternative transportation fuels. EPACT accelerates the purchase requirements for AFVs by the federal fleet, proposes eliminating the cap on CAFE credits that manufacturers can earn by producing dual- and flexible-fuel vehicles and requires fleets in large urban areas to purchase AFVs. Establishes tax incentives for purchasing AFVs, converting conventional gasoline vehicles to operate on alternative fuels and installing refueling or recharging facilities by the private sector.

Ethanol (also known as Ethyl Alcohol, Grain Alcohol, CH_3CH_2OH): Can be produced chemically from ethylene or biologically from the fermentation of various sugars from carbohydrates found in agricultural crops and cellulosic residues from crops or wood. Used in the United States as a gasoline octane enhancer and oxygenate, it increases octane 2.5 to 3.0 numbers at 10% concentration. Ethanol also can be used in higher concentration in alternative-fuel vehicles optimized for its use.

Etherification: Oxygenation of an olefin by methanol or ethanol. For example, MTBE is formed from the chemical reaction of isobutylene and methanol.

Ethyl Alcohol: See Ethanol.

GLOSSARY

Ethyl Ester: A fatty ester formed when organically derived oils are combined with ethanol in the presence of a catalyst. After water washing, vacuum drying and filtration, the resulting ethyl ester has characteristics similar to petroleum-based diesel motor fuels.

Ethyl Tertiary Butyl Ether (ETBE): An aliphatic ether similar to MTBE. This fuel oxygenate is manufactured by reacting isobutylene with ethanol. Having high octane and low volatility characteristics, ETBE can be added to gasoline up to a level of approximately 17% by volume. ETBE is not yet commercially available.

Feedstock: Any material converted to another form of fuel or energy product. For example, cornstarch can be used as a feedstock for ethanol production.

Fermentation: The enzymatic transformation by microorganisms of organic compounds such as sugars. It is usually accompanied by the evolution of gas, as in the fermentation of glucose into ethanol and CO_2.

Flexible-Fuel Vehicles (FFV): Vehicles with a common fuel tank designed to run on varying blends of unleaded gasoline with either ethanol or methanol.

Fuel Cell: An electrochemical engine (no moving parts) that converts the chemical energy of a fuel, such as hydrogen, and an oxidant, such as oxygen, directly to electricity. The principal components of a fuel cell are catalytically activated electrodes for the fuel (anode) and the oxidant (cathode) and an electrolyte to conduct ions between the two electrodes.

Gasohol: In the United States, gasohol refers to gasoline that contains 10% ethanol by volume. This term was used in the late 1970s and early 1980s but has been largely replaced by terms such as E-10 Unleaded with Ethanol, Super Unleaded Plus Ethanol or Unleaded Plus Ethanol.

GLOSSSARY

Global Warming: The theoretical escalation of global temperatures caused by the increase of greenhouse gas emissions in the lower atmosphere.

Greenhouse Effect: A warming of the earth and its atmosphere as a result of the thermal trapping of incoming solar radiation by CO_2, water vapor, methane, nitrous oxide, chlorofluorocarbons and other gases, both natural and man-made.

Hybrid-Electric Vehicle (HEV): A vehicle that is powered by two or more energy sources, one of which is electricity. HEVs may combine the engine and fuel system of a conventional vehicle with the batteries and electric motor of an electric vehicle in a single drivetrain.

Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA): An omnibus act that further integrates the national intermodal surface transportation system and authorizes funds for highway construction, highway safety programs, and mass transit programs. ISTEA seeks a national intermodal surface transportation system that is economical, energy efficient, and environmentally sound. Section 1008 of the ISTEA establishes the Congestion Mitigation and Air Quality Improvement Program which can provide funds to support alternative fuel and alternative-fuel vehicle programs.

Liquefied Natural Gas (LNG): Natural gas that has been condensed to a liquid typically by cryogenically cooling the gas.

Liquefied Petroleum Gas (LPG): A mixture of hydrocarbons found in natural gas and produced from crude oil, used principally as a feedstock for the chemical industry, home heating fuel, and motor vehicle fuel. Also known as the principal constituent of propane.

M-85: 85% methanol and 15% unleaded gasoline by volume, used as a motor fuel in FFVs.

M-100: 100% (neat) methanol.

Methanol (also known as Methyl Alcohol, Wood Alcohol, CH OH): A three-liquid fuel formed by catalytically combining CO with hydrogen in a 1:2 ratio under high temperature and pressure. Commercially, it is typically manufactured by steam reforming natural gas. Also formed in the destructive distillation of wood.

Methyl Tertiary Butyl Ether (MTBE): An ether manufactured by reacting methanol and isobutylene. The resulting ether has high octane and low volatility. MTBE is a fuel oxygenate and is permitted in unleaded gasoline up to a level of 15% by volume.

Natural Gas: A mixture of gaseous hydrocarbons, primarily methane, occurring naturally in the earth and used principally as a fuel.

Neat Fuel: Fuel that is free from admixture or dilution with other fuels.

OEM: Original Equipment Manufacturer.

Oxides of Nitrogen (NOx): Regulated air pollutants, primarily NO and NO_2 but including other substances in minute concentrations. Under the high pressure and temperature conditions in an engine, nitrogen and oxygen atoms in the air react to form various NOx. Like hydrocarbons, NOx are precursors to the formation of smog. They also contribute to the formation of acid rain.

Oxygenate: A term used in the petroleum industry to denote fuel additives containing hydrogen, carbon and oxygen in their molecular structure. Includes ethers such as MTBE and ETBE and alcohols such as ethanol and methanol.

Oxygenated Gasoline: Gasoline containing an oxygenate such as ethanol or MTBE. The increased oxygen content promotes more complete combustion, thereby reducing tailpipe emissions of CO.

Ozone: Tropospheric ozone (smog) is formed when volatile organic compounds (VOCs), oxygen and NOx react in the presence of sunlight (not to be confused with stratospheric ozone, which is found in the upper atmosphere and protects the earth from the sun's ultraviolet rays). Though beneficial in the upper atmosphere, at ground level ozone is a respiratory irritant and considered a pollutant.

Particulate Matter (PM): A generic term for a broad class of chemically and physically diverse substances that exist as discrete particles (liquid droplets or solids) over a wide range of sizes. A NAAQS pollutant.

Propane: See Liquefied Petroleum Gas (LPG).

Reformulated Gasoline (RFG): Gasolines that have had their compositions and/or characteristics altered to reduce vehicular emissions of pollutants, particularly pursuant to EPA regulations under the CAA.

Reid Vapor Pressure (RVP): A standard measurement of a liquid's vapor pressure in psi at 100 degrees Fahrenheit. It is an indication of the propensity of the liquid to evaporate.

Smog: A visible haze caused primarily by particulate matter and ozone.

Spark Ignition Engine: Internal combustion engine in which the charge is ignited electrically (e.g., with a spark plug).

U.S. Department of Energy (DOE): A department of the federal government, established by the Carter Administration in 1977, to consolidate energy-oriented programs and agencies. The DOE mission includes the coordination and management of energy conservation, supply, information dissemination, regulation, research, development and demonstration. The Department includes the Office of Transportation Technologies, the umbrella of the Office of Alternative Fuels.

GLOSSSARY

U.S. Environmental Protection Agency (EPA): A government agency, established by the Nixon Administration in 1970, responsible for the protection of the environment and public health. EPA seeks to reduce air, water and land pollution and pollution from solid waste, radiation, pesticides and toxic substances. EPA also controls emissions from motor vehicles, fuels and fuel additives.

Volatile Organic Compound (VOC): Reactive gases released during combustion or evaporation of fuel and regulated by EPA. VOCs react with NOx in the presence of sunlight and form ozone.

Vapor Pressure or Volatility: The tendency of a liquid to pass into the vapor state at a given temperature. With automotive fuels, volatility is determined by measuring RVP.

Xylene: An aromatic hydrocarbon derived from petroleum and used to increase octane. Highly valued as a petrochemical feedstock. Xylene is highly photochemically reactive and, as a constituent of tailpipe emissions, is a contributor to smog formation.

ACRONYMS

AFV . . . . . .alternative-fuel vehicle
AMFA . . . . . .Alternative Motor Fuels Act of 1988
Btu . . . . . .British thermal unit
BTX . . . . . .benzene, toluene, xylene
CAA . . . . . .Clean Air Act
CAAA . . . . . .Clean Air Act Amendments of 1990
CAFE . . . . . .Corporate Average Fuel Economy
CARB . . . . . .California Air Resources Board
CFFP . . . . . .Clean Fuel Fleet Program
CNG . . . . . .compressed natural gas
CO . . . . . .carbon monoxide
CO_2 . . . . . .carbon dioxide
DOE . . . . . .U.S. Department of Energy
DOT . . . . . .U.S. Department of Transportation
EPA . . . . . .U.S. Environmental Protection Agency
EPACT . . . . . .Energy Policy Act of 1992
ETBE . . . . . .ethyl tertiary butyl ether
FFV . . . . . .flexible-fuel vehicle
GVWR . . . . . .gross vehicle weight rated
HC . . . . . .hydrocarbon
LNG . . . . . .liquefied natural gas
LPG . . . . . .liquefied petroleum gas (propane)
MTBE . . . . . .methyl tertiary butyl ether
NGV . . . . . .natural gas vehicle
NOx . . . . . .oxides of nitrogen
OEM . . . . . .Original Equipment Manufacturer
PM . . . . . .particulate matter
RVP . . . . . .Reid Vapor Pressure
SO_2 . . . . . .sulfur dioxide
SOx . . . . . .oxides of sulfur
THC . . . . . .total hydrocarbons
VFV . . . . . .variable-fuel vehicle
VOC . . . . . .volatile organic compound

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CFDC CLEAN FUELS DEVELOPMENT COALITION

The Clean Fuels Development Coalition is a non-profit organization dedicated to the development of alternative fuels and technologies to improve air quality and reduce U.S. dependence on imported oil. The broad CFDC membership includes ethanol and ether producers, agricultural interests, automobile manufacturers, state government agencies, and engineering and new technology companies. Since its beginning in 1988, the Coalition has become a respected source of information for state, local, and federal policymakers as well as private industry on a range of transportation, energy, and environmental issues.