



# Understanding Fleets and Alternative Fuels



**Understanding Fleets and Alternative Fuels**

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**National Alternative Fuels Training Consortium**

West Virginia University  
Ridgeview Business Park  
1100 Frederick Lane  
Morgantown, WV 26508

Phone (304) 293-7882  
Fax (304) 293-6944  
E-mail: al.ebron@mail.wvu.edu  
Web site: www.naftc.wvu.edu

Introduction

The use of alternative fuels in fleet transportation is critical to achieving significant reductions in petroleum consumption. The application of various alternative fuels in fleet vehicles will help curtail the nation's dependence on imported oil, lead to reduced emissions, and provide greater energy security.

Rising fuel costs coupled with more stringent emission standards are two of the challenges facing fleet managers today. With petroleum prices continuing to fluctuate, government regulations constantly changing, and pressure from environmentally conscious customers to help "green" the way goods and services are delivered, fleet managers are under growing pressure to deal with these fuel management issues in an efficient manner.

Fleet managers play an important role in the deployment of alternative fuels because they control 10.8 million vehicles on U.S. roadways. They are also aware of the changing environment around which mandates and incentives encourage the use of alternative fuel vehicles (AFVs). The use of AFVs in fleets is growing as alternative fuels and vehicles make advancements in technology, safety, and availability. The use of AFVs in fleets can also act as an opportunity to showcase these vehicles to the public which will create more awareness and opportunity for consumer use as well.

Fleet managers remain instrumental in the application of alternative fuel technologies, and their fleets often serve as proving grounds for new alternative fuel equipment. This material will showcase how alternative fuels can be successfully implemented in fleet applications. It provides general information on the eight key areas of fleet management and how AFVs fit into these management areas.

Objectives

- Discuss the role of fleet managers
• Explain what a green fleet is and why they are becoming important
• Identify alternative fuels for use in green fleets
• Discuss the eight key areas in fleet management and how alternative fuels and advanced technology vehicles relate to each

Fleets and the Roles of Their Managers

A fleet consists of all the operational vehicles that are used by a business or organization in order to operate (see Figure 1). These vehicles can range from light-duty corporate transportation vehicles to heavy-duty delivery and work trucks. The sum of these vehicles comprises the organization's fleet. Constant monitoring and review of the fleet's performance is pivotal to the businesses'

successful and efficient day-to-day operation. These fleets require budgeting, maintenance, and many other services. In order for all of these requirements to be satisfied there must be at least one individual responsible for the fleet. It is the responsibility of this individual to ensure the fleet operates within the company's established parameters to ensure the actual core of the business is successful. The roles of these fleet managers are evolving due to changes in public policy, government initiatives, energy costs, and business demands. When reacting to these changes, fleet managers must make internal decisions on vehicle replacements, retrofitting, and conversion costs, and onsite or offsite fueling and maintenance, as the fleet evolves.

Fleet operating costs are a significant portion of an organization's budget and are constantly under scrutiny by business managers and others with a vested interest in the businesses' success. In the meantime, energy price fluctuations and public regulations are affecting how fleet managers budget for fleet expenses. To meet public demands, government mandates, and budgetary requirements, fleet managers are considering petroleum reduction technologies today more than ever. The ability to implement these technologies is dependent on the fleet's function.

Fleets can be separated into two types, public and private. Public fleets are operated by federal, state, and local governments. These fleets are typically subject to mandates which include the use of alternative fuel and advanced technology vehicles. On the other hand, private fleets are those that are operated by private businesses and organizations. These fleets can choose to follow government mandates on a voluntary basis. Private fleets have



Figure 1: Fleet vehicles. Source: AFDC.

more flexibility and choices when implementing AFVs within their fleets to make them "green." This "greening of fleets" is becoming more common as companies are implementing green strategies and technologies to remain competitive in today's environment.

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Notes

To Green or Not to Green?

A green fleet is one that uses alternative fuels, advanced technology vehicles, and sustainable practices in order to reduce their carbon footprint, lower fleet emissions, improve fuel economy, and use domestically produced fuels. The federal government has issued mandates that have changed and continue to change public fleets. However, private fleets which are not subject to all mandates have different choices with respect to greening their fleets. For private fleet managers that would like to operate a green fleet it is important to know what qualifies as an alternative fuel. Various agencies define alternative fuels and these definitions must be understood for fleets to select the most practical option based on federal, state, and local alternative fuel definitions.

Alternative Fuels Defined

Alternative fuels are defined, by the 1992 Energy Policy Act (EPAAct), to help fleet managers accurately account for the number of alternative fuel vehicles that comprise a fleet. The Environmental Protection Agency (EPA) has also modified the definitions and criteria for renewable fuels in addition to those presented in previous EPAActs. The Internal Revenue Service (IRS) has separate definitions of alternative fuels necessitated by respective tax rebates. Fleet managers should be aware that many state governments have state income tax rebates for alternative fuel vehicles and often have a broader definition of what qualifies as an alternative fuel and subsequent tax rebates. Alternative fuel definitions from EPAAct, the EPA, and the IRS are detailed below.

EPAAct

"The following fuels are defined as alternative fuels by the Energy Policy Act (EPAAct) of 1992: pure methanol, ethanol, and other alcohols; blends of 85% or more of alcohol with gasoline; natural gas and liquid fuels domestically produced from natural gas; liquefied petroleum gas (propane); coal-derived liquid fuels; hydrogen; electricity; pure biodiesel (B100); fuels, other than alcohol, derived from biological materials; and P-Series fuels. In addition, the U.S. Department of Energy (DOE) may designate other fuels as alternative fuels, provided that the fuel is substantially nonpetroleum, yields substantial energy security benefits, and offers substantial environmental benefits. For more information about the alternative fuels defined by EPAAct 1992 as well as DOE's alternative fuel designation authority, visit the EPAAct website."

**EPA**

The EPA added additional criteria that must be met in order for alternative fuels to be considered renewable. Qualifying fuels must reduce greenhouse gas GHG emission over the lifecycle of the vehicle. Depending on GHG reduction threshold the fuel is further categorized based on the following levels.

- Renewable fuel = 20% GHG Reduction
- Advanced biofuel = 50% GHG Reduction
- Biomass-based diesel = 50% GHG Reduction
- Cellulosic biofuel = 60% GHG Reduction

**IRS**

“The Internal Revenue Service (IRS) defines alternative fuels as liquefied petroleum gas, compressed natural gas, liquefied natural gas, liquefied hydrogen, liquid fuel derived from coal through the Fischer-Tropsch process, liquid hydrocarbons derived from biomass, and P-Series fuels. Biodiesel, ethanol, and renewable diesel are not considered alternative fuels by the IRS. While the term ‘hydrocarbons’ includes liquids that contain oxygen, hydrogen, and carbon and as such ‘liquid hydrocarbons derived from biomass’ includes ethanol, biodiesel, and renewable diesel, the IRS specifically excludes these fuels from the definition.”

**SPECIAL NOTE:** Tax incentives have been available from federal and state governments in the past. To see if any incentives are currently available, check out: <http://www.afdc.energy.gov/laws/>

Now that alternative fuels have been defined, fleet managers may wonder if these fuels are actually being used in the U.S. The Energy Information Administration (EIA) reports on the domestic use of conventional and alternative fuels. **Figure 2** shows the fuel use trends from 2008 through 2010. This figure includes all of the fuels covered by the Petroleum Reduction Technologies manual. These alternative fuels are:

1. Biodiesel
2. Ethanol (E85)
3. Natural gas (compressed and liquefied)
4. Liquefied petroleum gas (LPG or propane)
5. Hydrogen
6. Electricity

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Notes

<i>(Thousand Gasoline-Equivalent Gallons)</i>			
<b>Fuel Type</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
<b>Alternative Fuels</b>			
Compressed Natural Gas	189,358	199,513	210,007
Electricity	5,050	4,956	4,847
Ethanol, E85	62,464	71,213	90,323
Hydrogen	117	140	152
Liquefied Natural Gas	25,554	25,652	26,072
Liquefied Petroleum Gas	147,784	129,631	126,354
Other Fuels	2	2	-
Biodiesel	324,329	325,102	235,188
Methyl Tertiary Butyl (MTBE) and Other Oxygenate	-	-	-
Ethanol in Gasoline	6,442,781	7,343,133	8,527,431
<b>Alternative Fuels Total</b>	<b>7,197,439</b>	<b>8,099,342</b>	<b>9,220,374</b>
<b>Traditional Fuels Used On-Highway</b>			
Gasoline	134,644,492	134,385,175	134,686,678
Diesel	41,434,412	37,701,896	39,319,551
<b>Traditional Fuels Total</b>	<b>176,078,904</b>	<b>172,087,071</b>	<b>174,006,229</b>
<b>Total Vehicle Fuel Consumption (Alternative plus Traditional Fuels)</b>	<b>183,276,343</b>	<b>180,186,413</b>	<b>183,226,603</b>
<b>Alternative Fuels Percentage</b>	<b>3.9%</b>	<b>4.5%</b>	<b>5.0%</b>

**Figure 2:** *Estimated Consumption of Vehicle Fuels in the United States by Fuel Type, 2008-2010.*  
Sources: U.S. Energy Information Administration.

It can be seen that when the sum of all alternative fuels is compared to the sum of conventional gasoline and diesel fuel, that use of alternative fuels annually increased by 0.55%. The percentage of alternative fuels used in 2010 was 5.0%. It should be noted that the numbers presented in Figure 2 are in Thousand Gasoline Gallon Equivalents or Thousand GGEs. In order to represent the values in GGEs, each should be multiplied by 1,000.

**‘Drivers’ of Change**

From the above figure it can be seen that use of alternative fuels is on the rise. Fleet managers may wonder, what are the ‘drivers’ of this change in fuel use? The drivers of change are influences that are pushing consumers and fleets (both public and private) to green themselves through the use of alternative fuels and advanced technology vehicles. The main drivers of change are:

- Consumer awareness about petroleum consumption and its effects
- Price increases and fluctuation of conventional fuels
- Corporate image
- Federal, state, and local mandates and incentives



Each of these drivers should be considered by fleet managers looking at greening their fleets. Fuel and vehicle expenses represent significant budget expenses for fleet managers, businesses, organizations, and day-to-day expenses of consumers. There are currently more than 225 million vehicles operating in the U.S. alone. These vehicles include fleet and personal vehicles. Vehicle fuel consumption represents more than 70% of U.S. petroleum consumption with daily use over 11 million barrels per day! According to the EIA the U.S. imported nearly half of its oil (see **Figure 3**) and used nearly 22% of the petroleum consumed worldwide in 2010. Transportation petroleum reductions represent a significant area for reducing the nation's petroleum demand.

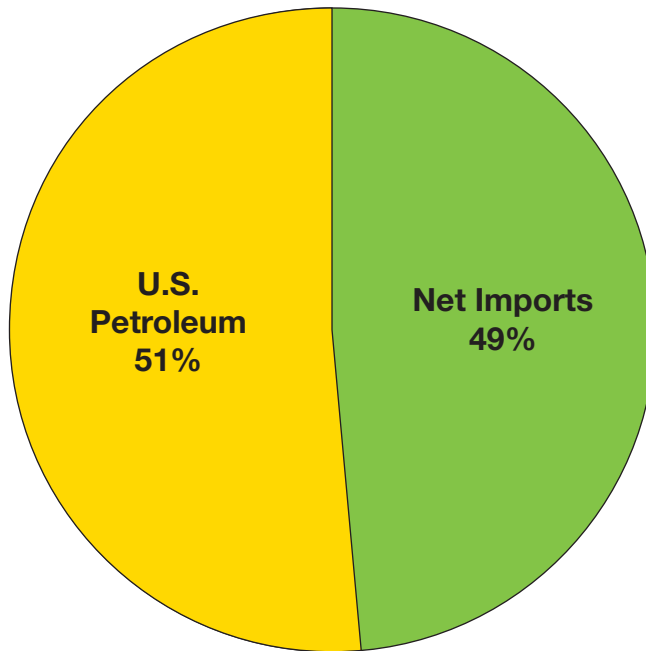


Figure 3: Net imports and domestic petroleum as shares of U.S demand, 2010. Source: EIA.

*Transportation fuel accounts for over 2/3 of national petroleum consumption and remains the second largest expense in a fleet manager's budget.*

Lined area for notes.



Notes

A further breakdown in oil consumption shows that 72% of U.S. oil is consumed by the transportation sector for a total of 4.9 billion barrels of oil (see **Figure 4**). Of that, light-duty vehicles and trucks and buses represent a majority of fuel consumption. These vehicles and the fleets that use these vehicles are the focus of this section of the Petroleum Reduction Technologies manual.

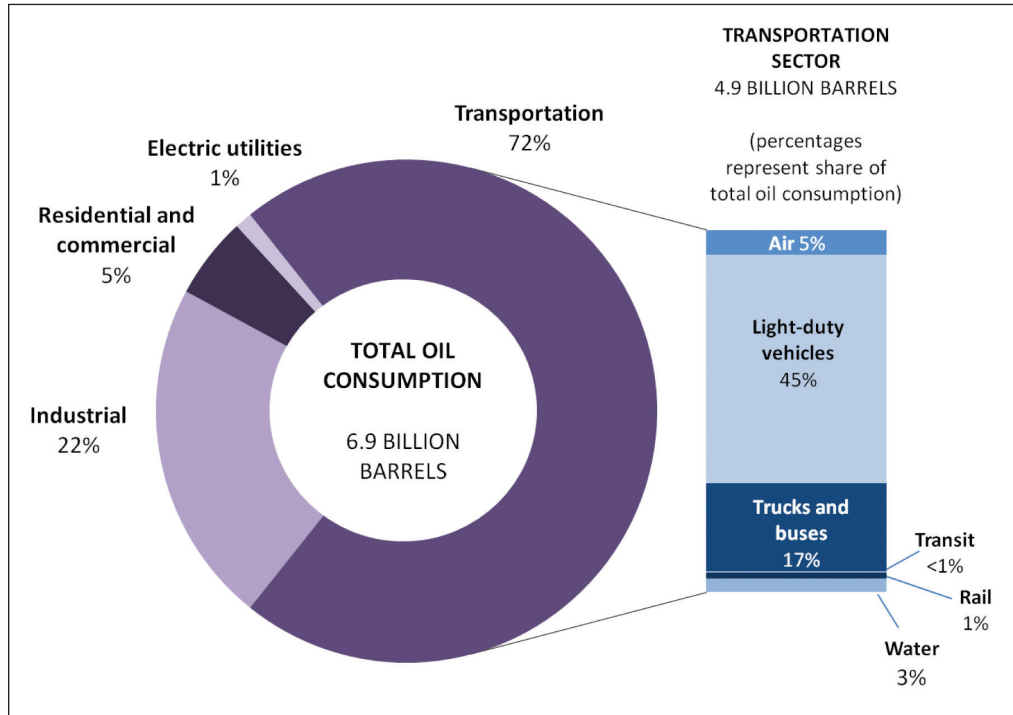


Figure 4: Estimated consumption of vehicle fuels in the U.S. by fuel type. Source: EIA.

**Federal Fleets Lead by Action**

As mentioned above the federal government has been a major driver of change with respect to the increased use of alternative fuels. The federal government through the National Highway Traffic Safety Administration (NHTSA) and Environmental Protection Agency (EPA) continues to decrease new vehicle emissions limits while increasing Corporate Average Fuel Economy (CAFE) standards. Since 1975, the NHTSA has set fuel economy standards that require vehicle manufacturers to produce clean and efficient vehicles. These CAFE standards remained nearly unchanged throughout the past 30 years but in 2007 the government passed the Energy Independence and Security Act. This Act focused on reducing U.S. fuel consumption by 20% in 10 years. This raised the CAFE standard for passenger vehicles from 27 miles per gallon (MPG) to 35 MPG by 2020. The Obama administration raised the goal to 54.5 MPG by 2025 which equates to a CAFE yearly increase of 5%. The EPA has also set new emissions standards which require manufacturers to not only produce more efficient vehicles but ones that produce significantly lower emissions than their predecessors.

In response to Presidential Memoranda and industry commitment, NHTSA and EPA established a national program in 2010 that set increased fuel economy standards and the first ever national greenhouse gas emissions standards for light-duty vehicles through Model Year 2016. These changes are expected to result in savings of more than \$3,000 over the lifetime of the vehicle. The agencies are proposing to extend the program through Model Year 2025. This second phase alone is projected to save approximately 4 billion barrels of oil when you consider the full life of those vehicles sold. Other fuel economy and emissions standards are in place for medium- and heavy-duty vehicles.

*“These programs, combined with the model year 2011 light truck standard, represent the first meaningful update to fuel efficiency standards in three decades and span Model Years 2011 to 2025. Together, they will save American families \$1.7 trillion dollars in fuel costs, and by 2025 result in an average fuel savings of over \$8,000 per vehicle.”*

<http://www.whitehouse.gov/the-press-office/2011/07/29/president-obama-announces-historic-545-mpg-fuel-efficiency-standard>

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### Key Areas of Fleet Management

The National Association of Fleet Administrators (NAFA) has identified eight key areas in fleet management for any and all fleets. This section will introduce these eight areas with respect to conventional fleet management and then highlight the connection with alternative fuels and other petroleum reduction technologies. As private or other public fleets follow the path of the federal government, the roles of fleet managers will evolve to include new topics related to AFVs which will affect fleet management. The eight key areas identified by NAFA are:

1. Asset management
2. Business management
3. Fleet Information management
4. Maintenance management
5. Risk management
6. Financial management
7. Professional development
8. Vehicle fuel management

#### Asset Management

##### Conventional Fleets

Asset management is the task of managing and controlling all of a company's tangible and intangible assets. This involves handling the company's vehicles, facilities, inventories, employees, and outside vendor relations. This particular portion of management focuses heavily on efficient resource management.

For managers of conventional fleets the key areas of asset management are:

- Vehicles
- Facilities and equipment
- Employees

##### Green Fleets Connection

Asset management will evolve as a fleet becomes green. A green fleet may consist of conventional, converted, and dedicated AFVs, all of which are assets. With the addition of these vehicles, the fleet will require additional equipment such as special tools, safety equipment, analyzers, and sensors for AFV operation. Many fleets already have assets related to onsite fueling equipment but these assets may grow with the addition of separate alternative fuel storage and delivery systems. In the case of electric vehicles this may include multiple charging stations and related electrical equipment. As mentioned above, employees are a main and important asset of any fleet. Employees are also an

invaluable asset to fleet managers who wish to operate a green fleet. These employees must be trained and knowledgeable about the new fleet assets. Fleet managers are tasked with maintaining high worker morale during fleet conversion and providing adequate training of employees to allow for peak fleet operation. In order to see the full benefits of a green fleet, asset management of new equipment is pivotal.

*For Example*

As a specific example, fleets that wish to convert to natural gas have many options for onsite fueling. In any case of onsite fueling, new filling equipment will require investment. For smaller light-duty fleets converting to compressed natural gas (CNG) there is time-fill CNG fueling equipment available (see **Figure 5**). This type of equipment can be installed indoors and out (such as BRC Fuel Maker Phill or individual time-fill posts at fleet on-site parking slots outdoors) and can fill a light-duty CNG vehicle tank overnight. For larger fleets, investment in a larger scale onsite fueling station may require additional assets in the form of alternative fuel storage equipment and fueling equipment, similar to conventional private or public filling stations. **Figure 6** shows a dedicated onsite LPG fueling system. In the background are the fueling pumps and in the foreground is the additional propane fuel storage system. This type of asset may be found in larger fleets such as the Yellow Checker Star cab company which operates a fleet of propane-fueled taxis. Additional information about this case study can be found in the Propane Fleets Application section.



**Figure 5:** CNG time-fill station. Source: NAFTC.



**Figure 6:** Large LPG storage tank for propane vehicle fueling station. Source: NAFTC.

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Notes

**Business Management**

*Conventional Fleets*

Business management encompasses the education, policies, and laws that affect the business in day-to-day operations. These interactions may deal more with outside agencies than asset management. Much of this portion of management is concerned with the business’s compliance and relationships with support and complementary business entities. For managers of conventional fleets the key areas of business management are:

- Outside agencies
- Compliance
- Relationships
- Internal policies and procedures
- Streamlined operation

*Green Fleets Connection*

Business management is directly related to conversion and operation of a green fleet. Fleet managers must be aware of the best practices for obtaining and implementing the use of AFVs and green fleet practices. They will be required to work with outside agencies to obtain equipment warranties, fuels, and other components necessary for fleet operation. Business management of a green fleet will require additional training for all employees interacting with the fleet including maintenance and vehicle operators. Internal training programs will work hand-in-hand with outside agencies which will allow managers to communicate directly with public health and safety departments to ensure proper permitting. Safety training is key for efficient and safe operation of any vehicle and especially with new types of vehicles that represent a large asset.

Fleet managers can also reach out to other fleets to form external relationships related to fueling stations. Multiple fleets using the same alternative fuel can aggregate fuel volumes, making it attractive for energy management companies or fuel providers who specialize in alternative fuel infrastructure to build a fueling facility on “neutral” ground accessible to all fleets who commit to deploy the vehicles. This ensures use of the fueling infrastructure being built and takes this cost burden off of the fleet. This type of business interaction and partnership development is crucial.

Public fleet managers must follow specific business practices that are outlined in government mandates but private fleet managers will have more flexibility when implementing business practices associated with the new fleet. Marketing of these new business assets and practices may also fall to the business manager and require interaction between the managers and other internal business

members. Consumer acceptance and awareness about business operations may be valuable in today's environmentally conscious market.

*For Example*



**Figure 7:** Giant Eagle program introducing and training employees on AFVs. Source: NAFTA.

For complete business management with AFVs there will be key internal and external relationships formed. As seen in **Figure 7**, maintenance and operator training is pivotal for green fleet operation. Giant Eagle has made sure to provide adequate internal training to technicians. More information can be found in the case study

of the Natural Gas Fleets Application section.

New external relationships will also be formed. An example may be the new business relationship between your fleet and its alternative fuel provider. There are many alternative fuel suppliers available and vary with location. These fuel suppliers may be different than those providing conventional fleet fuels. Simple Fuels Biodiesel in California (see **Figure 8**) has established a strong network of companies that purchase biodiesel from their waste oil recycling operation. More on this company can be found in a Biodiesel Case Study at <http://assets.slate.wvu.edu/resources/527/1342557900.pdf>. This type of external relationship will be important to both partners when looking at the sustained practice of operating a green fleet. These relationships will also vary by fuel and technology.



**Figure 8:** Fuel delivery truck. Source: NAFTA.

Notes

**Fleet Information Management**

*Conventional Fleets*

Fleet information management deals with tracking and operating the business's fleet in the most efficient way possible. This can be accomplished by using a number of vehicle technologies and techniques. Also, fleet information management may deal with maintaining relationships with third party service providers based on fleet information databases. Managers of fleet information may work directly with the organizations information technology (IT) department for computing hardware, operating systems, and data storage capabilities. Fleet information management is already important for the operation of fleets using conventional fuels. For managers of conventional fleets the key areas of fleet information management are:

- Fleet data
- Logging and documentation
- Third party interaction
- Database of information

*Green Fleets Connection*

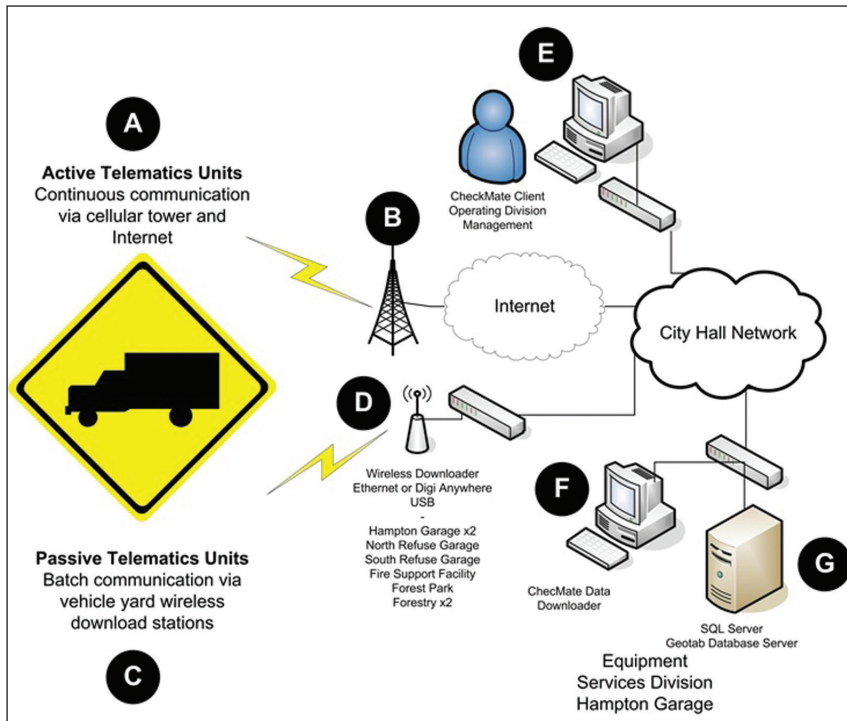
Once new assets have been purchased for a green fleet they must be tracked and monitored for proper fleet operation. Since conversion will introduce new vehicles into the fleet, it is critical that these vehicles be monitored for efficient fleet operation during and after conversion. Unique issues may arise and will require proper documentation of the problem and solution in order to prevent future problems or downtime. Proper information management can decrease the uphill learning curve associated with change. These new vehicles and technologies require documentation related to employee and staff training. Proper permits, safety documentation, placards for vehicles and fueling equipment, and vehicle inspections must all be carefully documented and filed in order to eliminate fines or unwanted incidents.

With respect to vehicles themselves, there should be a system in place for documenting hours of operation, driver logs, vehicle miles, scheduled service intervals, and fuel use patterns. One way to efficiently track this data is through the use of telematics. Telematic systems record vehicle data which can then be downloaded to vehicle information databases. These systems can help streamline monitoring and allow for more efficient fleet management. These systems can quickly alert fleet managers of problems or issues that require a quick solution to ensure fleet efficiency and operator safety.



## For Example

Use of third party telematics is not required for fleet information data management but is an option that has been used by real world fleets. For example, The City of St. Louis has implemented a telematics system in 313 of its fleet vehicles. The system helps fleet managers to log various vehicle data which includes routes, speed, distance traveled, and amount of time at rest. Telematics can help fleets properly operate vehicles in order to see the full benefits of strategies discussed in the fuel economy and idle reduction sections of this material. The City of St. Louis used data gathered from its telematics systems to modify routes and driver practices (see **Figure 9**). They were able to increase the fuel economy of each vehicle by about 7-8% which leads to a return on investment (ROI) period of just over 18 months and an estimated savings of \$7,000 to \$8,000 over the life of each vehicle. With a quick ROI it can be seen that modifications of routes and practices can be a crucial part of reducing a fleet’s petroleum consumption. These options may also be popular for fleets of relatively newer vehicles, which still have significant useful life remaining before conversion is feasible. Another candidate may be fleets that have already converted to alternative fuels or advanced technology vehicles. A well monitored and maintained fleet will perform with greater efficiency.



**Figure 9:** How a telematics information gather system works. Source: Chris Amos, Commissioner of Equipment Services for the City of St. Louis.

Notes

**Maintenance Management**

*Conventional Fleets*

Maintenance management ensures all maintenance is completed on time for equipment and vehicles as well as ensuring mechanics maintain the necessary training and skills to perform the required maintenance. In order to offer the best service and support for the business' fleet, managers must ensure that their employees are kept up-to-date with the latest training and education. By keeping up with both equipment and employee maintenance needs and training, fleets will be able to better manage down time and increase efficiency. Conventional vehicles must meet required inspection standards in most areas on a yearly basis. For managers of conventional fleets the key areas of maintenance management are:

- Peak efficiency of vehicles
- Employee training
- Equipment and employee maintenance
- Reduction in downtime and increased efficiency
- Environmental (fluid and waste disposal)

*Green Fleets Connection*

Maintenance management of green fleets is just as important if not more important than when compared to conventional fleet maintenance. These new vehicles will require proper supervision by maintenance to ensure they are being properly used and fueled. An AFV that is not well-maintained could receive worse fuel economy and produce more emissions than conventional fleet vehicles. Maintenance requirements may increase when considering that fleets may now be comprised of a mix of conventional vehicles and AFVs. The additional vehicles will require additional maintenance and safety training. Once employees have been properly trained they must then keep proper and well documented service records. These records can be used in order to ensure that required tools and components such as fuel filters are always readily available in case a vehicle requires emergency servicing.

It may prove beneficial for maintenance managers to reach out to other fleets that have already had similar conversions. This could provide insight into assets that may need to be purchased to ensure onsite maintenance can quickly occur. This may also provide tips and things to watch out for during the conversion process which can save your fleet both time and money. In some cases it may make economic sense to outsource AFV specific maintenance to local garages that already have the tools, equipment, and experience on hand. Outsourcing maintenance would require up-to-date fleet information and maintenance service records to be available. These would be required in financial and business areas to establish and maintain working relationships with third parties to ensure limited fleet downtime.

Onsite storage systems themselves will require maintenance and specific training. High pressure fuel storage or electric charging equipment may be new to maintenance employees and proper safety training must occur if this equipment is to be serviced in house.

Record keeping of maintenance records is important for many reasons. These records can help optimize efficiency while reducing operational costs. AFVs that are not properly maintained may be consuming more fuel and producing more emissions than conventional vehicles. The root cause of these problems should be identified and separated from negative associations with the fuel or conversion. Many conversions may be made in order to save on fuel costs. It should be understood that any vehicle that is **NOT** properly maintained may consume more fuel and cost more to operate than a well maintained counterpart.

*For Example*

The importance of maintenance can be seen from companies that keep maintenance records and actively monitor fleet vehicles for operating issues. The Walled Lake Consolidated School District (WLCSD) (see **Figure 10**) wanted to limited idle time of its fleet vehicles in order to improve fleet fuel economy and reduce emissions. The District monitored vehicle idle time, fuel consumption, and other trends. When drastic changes were seen in fuel consumption, the trained maintenance team could use the fleet information data to quickly identify



**Figure 10:** A maintenance worker checking diagnostics and inspects one of the 119 buses at WLCSD's transportation facility. Source: Jill Segal, District Transportations Supervisor.

the problem by examining the issue to determine if it was a maintenance or operator issue. This method allowed for quick inspection and resolution of maintenance problems yielding a more fuel efficient fleet. AFV maintenance is key for the smooth, safe, and efficient operation of a fleet and directly relates to business and fleet information management. To learn more on WLCSD, check out the Case Study located in the Idle Reduction Fleet Applications section.

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Notes

**Risk Management**

*Conventional Fleets*

Risk management pertains to the actions fleet managers take to avoid accidents and the ability of the manager to plan ahead to appropriately deal with accidents if they occur. Managers must ensure that their employees are equipped with the knowledge to handle accidents and events that will happen with the vehicles in the fleet. This may involve training the employees to handle situations that will arise while operating the vehicles.

The appropriate insurance coverage must be maintained and up-to-date in order to cover all fleet assets. Risk management should also forecast situations that may arise even though some incidences will be unforeseen. Since unforeseen incidences will occur, fleet management must be able to take action after the incident to modify behavior for future risk prevention. Operators of all vehicles should be carefully screened and selected. For managers of conventional fleets the key areas of risk management are:

- Prevention and preparedness
- Control and mitigation
- Insurance

*Green Fleets Connection*

Risk management is a paramount issue when converting a fleet to use alternative fuels. Safety training is key in eliminating risks as well as improving the understanding and confidence of employees that will work with these AFVs on a daily basis. Risks should be minimized to allow for an easy, smooth, and safe transition. All vehicles have inherent risks and AFVs should not be approached with any additional or less respect than conventional vehicles. Those that become familiar with the technology will feel safer during operation and maintenance. Everyone within or near fleet operations should feel comfortable with and be knowledgeable about the vehicles, their operation, and their fueling procedures. Proper training can minimize health risks as well as risks to the tangible assets of vehicles and equipment.

Beyond an employees need to feel safe, there are legal permits and codes that must be followed to ensure a safe working environment. Any items with inherent risks should be labeled. Government and various organizations have uniform placards, images, and codes that are used to ensure universal understanding and safety. In many cases of storage or transport of alternative fuels there are legal obligations to properly identify fuels with placards and permits.

Proper insurance must be used when operating an alternative fuel vehicle fleet. Risk management practices can be used for prevention and risk mitigation but fleet managers need to be fully prepared in the case of an accident. Insurance must be up-to-date to include AFV components and their operation. Fueling equipment, additional shop, and storage area insurance may be needed to ensure that all fleet assets are covered in the case of an accident.

For Example

An example of risk prevention is the proper labeling of fuels. These labels are important to fuel users and first responders in the case of accidents. Local regulations may require placards for both the transportation of fuels (see **Figure 11**) and onsite fuel storage (see **Figure 12**) along with other labels. Even if these placards are properly displayed, risks might not be mitigated unless proper employee safety training has occurred. If a fuel storage tank is legally and properly displaying an NFPA placard as shown in Figure 11, it is not necessarily fool proof. Proper safety training that teaches employees what the placards mean is also required to prevent accidents.



Figure 11: DOT placard for fuel transportation. Source: DOT, PHMSA.

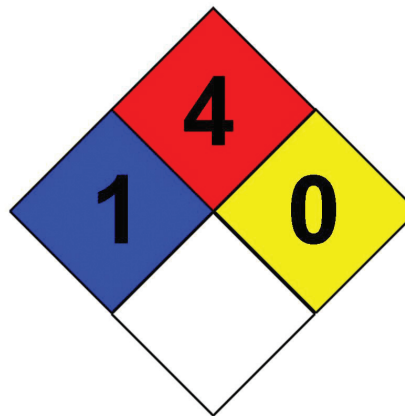


Figure 12: NFPA placard for stationary storage. Source: NFPA.

Proper placards and insurance are not enough without a trained and knowledgeable staff. Consider reading through the definitions of the NFPA placard shown in Figure 12. Did you know what the various diamond colors, numbers, and abbreviations meant? If you answered no, then there is a chance that your employees are unsure as well. Monetary insurance policies are not replacements for proper in-depth safety training.

Horizontal lines for taking notes.



Notes



Did You Know?

<b>NFPA Hazard Ratings</b>	
<b>Health (Blue)</b>	
4	Materials that under emergency conditions can be lethal.
3	Materials that under emergency conditions can cause serious injury.
2	Materials that under emergency conditions can cause temporary incapacitation or residual injury.
1	Materials that under emergency conditions can cause significant irritation.
0	Materials that offer no hazard beyond that of ordinary combustible material.
<b>Flammability (Red)</b>	
4	All liquids and gases with a flash point below 73°F and a boiling point below 100°F.
3	All liquids and gases with flash points at or below 73°F and a boiling point at or above 100°F and those liquids having flash point at or above 73°F and below 100°F.
2	All liquids with a flash at or above 100°F and below 200°F or solids that readily give off vapors.
1	All liquids, solids, and semi solids with flash points at or above 200°F.
0	Materials that will not burn.
<b>Reactivity (Yellow)</b>	
4	Materials readily capable of detonation or explosive reaction at normal temperatures and pressures.
3	Materials which when heated and under confinement are capable of detonation and which may react violently with water.
2	Materials which will undergo a violent chemical change at elevated temperatures and pressures but do not detonate.
1	Materials which are normally stable but may become unstable in combination with other materials or at elevated temperatures and pressures.
0	Materials that in themselves are normally stable, even under fire conditions.
<b>Special Hazards (White)</b>	
<b>W</b>	(water reactive)
<b>OXY</b>	(oxidizing material)
<b>CRY</b>	(cryogenic material)
<b>COR</b>	(corrosive material)
<b>POI</b>	(poisonous material)

Source: NFPA.

**Financial Management**

*Conventional Fleets*

Financial management includes forming a budget for the business' fleet, and making financially feasible purchases when buying vehicles for the fleet. Managers must consider the initial cost of the vehicle, the cost of fuel for the vehicle, and any alternatives there may be to the vehicle or fuel. Also, managers must consider the optimal replacement cycles for each vehicle they choose. For managers of conventional fleets the key areas of financial management are:

- Leasing/purchasing
- Return on investment (ROI)
- Replacement/lifecycle analysis
- Outsourcing
- Budgets

*Green Fleets Connection*

Financial management is key for any fleet. Financial management of a green fleet will require interaction between business, asset, maintenance, and vehicle fuel management. Before conversion of a fleet, financial decisions must be made to determine the most economically viable option for vehicle and fuel conversion. Conversion in this case refers to fleet conversion to green or sustainable practices. However, there are various vehicle options that must be considered beginning with the decision to purchase or lease AFVs. For conventional fleet vehicles there are also options for the physical conversion of vehicles to run on alternative fuels which may help offset capital expenses when compared to the purchase of OEM vehicles. New fleet vehicles may make financial sense when replacing conventional vehicles that are near the end of their useful lifecycle. For fleets that have relatively 'young' vehicles, conversion kits may make more financial sense. Some AFVs may also be available as used vehicles which can save on capital investment.

Once the financial decisions have been weighed and the new assets are implemented there must be more financial planning to develop training for safety, maintenance, and all employees. Maintenance may be outsourced to save on maintenance training costs. Onsite or offsite fueling is a crucial decision that must be weighed financially before fleet conversion. Fuel costs are a significant portion of a fleet's operating expenses. For the case of onsite fueling, financial planning can be used to properly size onsite fuel storage to balance how quickly the alternative fuel is used with the benefits of high volume bulk purchases. There have previously been tax incentives for alternative fuel use. Federal, state, and local government websites should be checked often for any incentives and tax rebates that will help in the operation of a green fleet.

Finally, financial management will be closely related to vehicle fuel management. Sudden financial expenditures may be used to identify issues with fuel economy or vehicle operation. These sudden costs should be analyzed by those in charge of vehicle fuel and maintenance management in order to remedy problems quickly to ensure the full economic benefits of operating a green fleet.

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For Example

An example of financial management decisions can be seen in looking at case studies of fleets that have not only successfully converted to use alternative fuels but have seen the financial benefits. President and CEO of Rossmoor Pastries Charles Feder, weighed multiple financial options and decided to convert his delivery fleet to CNG (see **Figure 13**). Feder chose to purchase pre-owned CNG vehicles and replace fleet vehicles over time. Fleet vehicles were bought and sold at auction. Maintenance was outsourced to a local company that specializes in alternative fuel technology to save on expenses and eliminate excess downtime. This fleet also decided to use onsite fueling in order to track and save on fueling costs. The company recently upgraded their onsite compressor station. Feder estimated that fleet conversion had actually yielded financial savings of \$480,000 over the life of the first compressor station alone. It should be noted that some savings have also been obtained from savings in time and fuel from vehicle use in high occupancy vehicle (HOV) lanes. This option is offered in many areas and should be considered as an extra financial benefit. To learn more about Rossmoor Pastries check out the case study online at <http://assets.slate.wvu.edu/resources/527/1342723052.pdf>.



**QUICK FACTS**

**Fuel Type:** Natural Gas (CNG)

**Fuel Production:**  
Onsite natural gas compressor station  
CNG Vehicles: 17 (94% of fleet)

**Fuel Consumption:**  
Over 34,000 gallons of natural gas per year

**Driving Range:** Up to 180 miles



Figure 13: Rossmoor Pastries CNG vehicle fleet. Source: Rossmoor Pastries.



**Professional Development**

*Conventional Fleets*

Professional development covers continual education for all fleet employees as well as the overall corporate image and reputation as seen by the public. Continuous training may be necessary to maintain the level of service and support required by fleet employees. Managers must also develop an ethical standard by which all employees operate. A major component of this standard may deal with corporate responsibility and environmental concerns. For managers of conventional fleets the key areas of professional development are:

- Top-to-bottom training
- Ethical standards
- Corporate responsibility and leadership
- Environmental concerns

*Green Fleets Connection*

Operating a green fleet can be beneficial to the corporate/public image of an organization. The continued education of the entire staff for fleet conversion is beneficial since all staff members should feel comfortable about discussing the benefits of fleet conversion. A knowledgeable staff can be an asset to the company since they can help spread the word on AFVs. A knowledgeable and professional staff will also allow the fleet to operate at maximum efficiency. In today's technology driven consumer markets, awareness is everywhere. Concerned citizens or consumers can easily research an organization's fleet details. Some may choose which company or organization to use based on fleet and business practices. Green branding can be used as a marketing tool that can attract new customers, reinsure consumer acceptance, and allow for the company to act as stewards. There are many partnerships such as the U.S. DOE Clean Cities Program that can give your fleet added benefits and assistance from other fleets that have also converted. It is the current trend that most companies and organizations are developing internal sustainability programs. The main focus of sustainability programs is on the reduction of the organization's carbon footprint. Working with a sustainability program can function as an additional outlet to advertise the benefits of your AFV fleet and the overall public image of your operations.

For Example

If your company or its fleet is going green you may also want to develop a sustainability program. This is a chance to highlight your green fleet and brand your company as green. A sustainability program allows for internal and external outreach to further distribute knowledge, among employees and concerned citizens, of why alternative fuels and advanced technology vehicles are a pivotal part of a sustainable future.

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Notes

The University of North Carolina (UNC) fleet has gone green in a number of ways. One primary method has been through the use of ethanol and flexible fuel vehicles. Other methods have included the use of battery electric vehicles in some campus locations. With ethanol use alone, the UNC fleet has displaced 61,000 gallons of petroleum annually. Through the development of sustainability programs (see **Figure 14**) these benefits have been advertised as part of various reports and UNC has developed online resources to show how UNC is reducing their carbon footprint.

Make your success story count by using all areas of management to produce reports which can be presented at local public events, universities, or high schools. This is a great opportunity to develop programs internally and externally which will advertise not only AFVs but your fleet as well.



Figure 14: Sustainability program, green branding, outreach program at UNC. Source: UNC.

Vehicle Fuel Management

Conventional Fleets

Vehicle fuel management deals with the manager's fuel choice and the environmental and economic impact it has on the fleet. Choosing certain fuels may be cost prohibitive for particular fleets. Also, as federal regulations continue to increase, certain fuels may be more appealing to the fleet for the economy they offer. For managers of conventional fleets the key areas of vehicle fuel management are:

- Fuel choice
- Budget
- Onsite or offsite fueling
- Fuel consumption tracking
- Forecasting

*Green Fleets Connection*

Fleets that are converting to AFVs must select the fuel type that best suits the needs of the fleet and makes the most economic sense. When selecting the right fuel, both onsite and offsite or centralized and decentralized fueling must be examined. Many public alternative fuel stations are available but counts are still lower than those for conventional fuels. Station availability and type also vary greatly with location. Decentralized fueling may require policies to ensure the use of alternative fuels whenever possible. Vehicle fuel cards that limit fuel purchases and locations can be useful in the area of vehicle fuel management as well as fleet information management. Decentralized fueling policies can also ensure that fuel quality and prices are monitored to maximize savings. All of these variables must be weighed to determine which fuel and fueling option is best for your fleet.

Fuel economy monitoring by fleet managers allows for quick identification of fleet operation problems. As fueling price trends increase, this data can be examined by maintenance to address any vehicle problems that are decreasing fleet efficiency. If no physical problems are found, fleet managers may need to address operator training to ensure the correct use of AFVs.

When a fleet decides to use onsite or centralized fueling it must consider which fueling method is best suited to fleet demands. Heavy-duty fleets that have decided on natural gas then need to decide to invest in CNG or LNG fueling infrastructure. For CNG alone there are choices of time-fill or fast-fill stations that will vary the required vehicle down time for fueling purposes. The same decisions must also be made for electric vehicles. There are currently three levels of charging for plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs). Charging levels may be indicated by Levels 1, 2, or 3. As the levels increase, the required charge time decreases. Charging at certain times or levels may have added financial benefits that must also be considered.

Onsite vehicle fuel management of AFVs also requires that proper labels, permits, and placards are in place to ensure safe operation of an internal fueling infrastructure.

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## Notes

Record keeping and research can be powerful tools to keep fleets running at peak efficiency. During the initial conversion to an alternative fuel, the fuel economy of the fleet may appear to decrease based on conventional measures. To better understand the fuel economy of AFVs fuel economy should be examined based on gasoline gallon equivalents (GGEs) or miles per gasoline gallon equivalent (MPG<sub>e</sub>). All fuels have different energy contents based on mass and volume and this should be considered when comparing to conventional fuels. The full benefits can be better represented by using these units of measure.

### For Example

Alternative fuel stations exist nationwide but are still less common than some alternative fuels. A key decision will be to use centralized or decentralized fueling. Many fleets already use onsite fueling in order to control fuel quality, track trends in use, and save through bulk purchases of fuel. Vehicle fuel management is connected to both business and information management. The University of Central Florida (UCF) chose to use E85 as its alternative fuel and installed an onsite fuel station to ensure the fuel's use (see **Figure 15**). The fuel is purchased from a local production company that delivers ethanol to the onsite fuel storage system and it is blended at the UCF facility. Vehicle fuel consumption is monitored at the pump and vehicle miles traveled are recorded through information management to provide fuel economy data on the flexible fuel fleet as whole. This information can then be used to forecast future fuel consumption and purchase rates as well as provide information to advertise the university's alternative fuel use.

To learn more about UCF's E85 fleet check out the case study online at <http://assets.slate.wvu.edu/resources/527/1342723053.pdf>.



**Figure 15:** University of Central Florida's E85 onsite fueling station and fueling infrastructure. Source: University of Central Florida.



Notes

Summary

Public and private sector fleet management is evolving rapidly. Fleet managers must be aware of all available fuels and technologies to choose the right option(s) for their fleet’s function. After a fleet has converted to AFVs it can be marketed as a green fleet which may boost public image and consumer acceptance of fleet operation. There are many options available to help green a fleet. Benefits of each option should be carefully weighed and subsequent implementation should be tailored to each fleet. This material was presented to help fleet managers understand how the increasing role of alternative fuels will affect the eight key areas of fleet management. Fleet managers should also remember that additional practices and technologies are available to improve any vehicle fuel economy and reduce idle time. All of these options are continuously changing the fleet management landscape.

The following sections address topic specific information including cost, availability, performance, and additional materials on each of the following:

- Biodiesel
- Ethanol
- Natural Gas
- Propane
- Hydrogen
- Electric Drive
- Fuel Economy
- Idle Reduction

## Additional Resources: Alternative Fuel Mandates for Fleet Managers

There are several federal fleet actions and mandates that shape the environment in which fleet managers operate. Many of the mandates are aimed at fleets within state and federal government agencies, along with fuel economy and emission standards for manufacturers. Fleet managers in private industries will be affected by these mandates as manufacturers produce more alternative fuel vehicles, as more alternative fueling infrastructure is deployed, and as cutting petroleum consumption becomes a primary priority. The following is a summary of relevant requirements and their implications for fleet managers.

- **Alternative Motor Fuels Act of 1988** – Requires federal fleets acquire the maximum number practical of alternative fuel passenger automobiles and light-duty trucks and requires federal agencies to make alcohol and natural gas available to the public.
- **Clean Air Act Amendments of 1990** – Mandates federal fleets meet implementation planning for clean-fuel fleet vehicles under the Clean Fuel Fleet Program.
- **Energy Policy Act of 1992** – Mandates alternative fuel vehicles must comprise at least 75% of the total number of light-duty vehicles acquired by federal agencies in a municipal service area (census population more than 250,000) in any fiscal year after 1999. Act also requires DOE provide resources and tools to agencies and consumers to support their efforts to acquire and use AFVs.
- **Energy Conservation Reauthorization Act of 1998** – Requires each agency to provide an annual report on AFV usage and for it to be made public.
- **Energy Policy Act of 2005** – Requires that dual-fuel vehicles use alternative fuel 100% of the time unless fuel is unavailable and increase the volume of renewable fuel that is blended into transportation fuels – increasing to 36 billion gallons per year by 2022.
- **Energy Independence and Security Act of 2007** – Requires federal agencies reduce annual petroleum consumption and increase alternative fuel consumption by implementing regulations that include assessing progress using numeric milestones and installing at least one renewable fuel pump at fleet fueling centers under their jurisdiction.
- **Executive Order 13423 in 2007** – Mandates that agencies with at least 20 motor vehicles must reduce petroleum consumption by 2% annually and increase alternative fuel use by 10% through 2015, relative to a 2005 baseline.

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For questions or further information, please contact:  
National Alternative Fuels Training Consortium  
Attention: Executive Director  
1100 Frederick Lane  
Ridgeview Business Park  
Morgantown, WV 26508  
Telephone: 304-293-7882  
Fax: 304-293-6944  
<http://www.naftc.wvu.edu>

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**National Alternative Fuels Training Consortium**

Ridgeview Business Park  
1100 Frederick Lane  
Morgantown, WV 26508



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