



# Motor Fuel Tax Issues with Natural Gas and Other Alternative Fuels (2013)

## Background

Due to various market forces including fluctuating fuel prices and increasingly restrictive laws and standards the use of alternative fueled vehicles has been expanding. Historical impediments to the expansion of the use of alternative fuels included issues with manufacture and distribution of the fuels; availability of refueling locations; and price of the fuel compared with the traditional fuels, gasoline and diesel. However, combinations of forces such as the increases in prices of the traditional fuels and the financial incentives offered by federal and state governments, has made the use of the alternative fuels more affordable. Finally, environmental issues, especially smog and pollution abatement require the use of lower-polluting and toxic fuels and in many cases the alternative fuels help meet the standards.

While not exhaustive, the following list identifies the most used alternative fuels in highway vehicles:

- Biodiesel
- Renewable Diesel
- Ethanol
- Natural Gas (CNG & LNG)
- Propane (LPG)
- Hydrogen
- Electricity

In addition, in recent years there has been an expansion of the sales of hybrid vehicles which combine gasoline engines with battery power to make the vehicles more efficient. While these would not present potential issues for fuel tax collections, their use would decrease the taxes paid vs. a vehicle that travels the same distance using just gasoline. This discussion of reduction in receipts to federal and state transportation trust fund revenues is a discussion for another day.

The following descriptions of the uses and benefits of the different fuels are taken from the US Environmental Protection Agency (EPA), Alternative Fuel Vehicles and Alternative Fuels, U.S. Department of Energy website, <http://www.fueleconomy.gov/Feg/current.shtml>

**BIODIESEL** - Biodiesel is a form of diesel fuel manufactured from vegetable oils, animal fats, or recycled restaurant greases. It is safe, biodegradable, and produces less air pollutants than petroleum-based diesel.

Biodiesel can be used in its pure form (B100) or blended with petroleum diesel. Common blends include B2 (2% biodiesel), B5, and B20. B2 and B5 can be used safely in most diesel engines. However, most vehicle manufacturers do not recommend using blends greater than B5, and engine damage caused by higher blends is not covered by some manufacturer warranties. Check with your owner’s manual or vehicle manufacturer to determine the right blend for your vehicle.

**RENEWABLE DIESEL** - Produced from biological sources Renewable Diesel meets all diesel ASTM D975 (Diesel) or D396 (Fuel Oil) standards. This product can be transported in pipelines with no upgrades required, unlike biodiesel which requires truck or rail transports. Renewable diesel (or green diesel) has a structural difference from biodiesel; it contains no fatty acid methyl esters and has no cold flow issues. Renewable diesel is produced using similar refining processes for producing petroleum diesel.



The key difference between renewable diesel and biodiesel is its chemical structure. Biodiesel contains fatty acid methyl esters (FAME), which are long, complex chains containing carbon, hydrogen, and oxygen. Renewable diesel is made up of totally organic hydrocarbons (hydrogen and carbon atoms only) just like petroleum diesel. Another difference is renewable diesel can be made from the sugars, starches, and cellulose material abundant in plants versus just using the seeds. Furthermore, with renewable diesel, various types of sewage and otherwise unusable waste streams such as used motor oil, fats, greases, waste vegetable oil, waste plastic materials (grocery bags, water bottles, etc.), and municipal solid waste (MSW) can also be used as feedstock.

**Advantages & Disadvantage of Renewable Diesel**

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Not reliant on a crude feedstock</li> <li>• Meets ATSM D975 and D396 standards</li> <li>• Can be transported via pipeline</li> <li>• Compatible with existing diesel engines</li> </ul>	<ul style="list-style-type: none"> <li>• Cost</li> <li>• Supply Availability</li> <li>• Labeling Requirements</li> </ul>

**ETHANOL** - Ethanol is an alcohol-based fuel made by fermenting and distilling starch crops, such as corn. It can also be made from "cellulosic biomass" such as trees and grasses. The use of ethanol can reduce our dependence upon foreign oil and reduce greenhouse gas emissions.

**E10** (also called "gasohol") is a blend of 10% ethanol and 90% gasoline sold in many parts of the country. All auto manufacturers approve the use of blends of 10% ethanol or less in their gasoline vehicles.

**E85**, ASTM D5798-11 specifications for E85 is a gasoline-ethanol blend containing 51% to 83% ethanol and can be used in flexible fuel vehicles (FFVs), which are specially designed to run on gasoline, E85, or any mixture of the two. State statutes may require a different ethanol % in order to be considered E85. FFVs are offered by several vehicle manufacturers. To determine if your vehicle can use E85, consult your owner's manual or check the inside of your car's fuel filler door for an identification sticker.

**NATURAL GAS** - a fossil fuel comprised mostly of methane, is one of the cleanest burning alternative fuels. It can be used in the form of compressed natural gas (CNG) or liquefied natural gas (LNG) to fuel cars and trucks.

Compressed natural gas (CNG) is typically stored in a tank at a pressure of 3000 to 3600 psi.

Liquefied natural gas (LNG) is super-cooled and stored in its liquid phase at -260° F in special insulated tanks.

Natural gas is usually measured by volume and is stated in cubic feet. For taxing purposes, natural gas consumed as a fuel in motor vehicles would be converted to either gasoline gallon equivalent (GGE) or diesel gallon equivalent (DGE) based on the energy content or British Thermal Units (BTU's). Conversion equations vary between states; however the Uniformity Committee (January 2013) is researching the issue and hopes to provide guidance to the states when converting natural gas to GGE/DGE gallons. (This paper will be revised to reflect the decision.)

Dedicated natural gas vehicles are designed to run on natural gas only, while *dual-fuel* or *bi-fuel* vehicles can also run on gasoline or diesel. Dual-fuel vehicles allow users to take advantage of the wide-spread availability of gasoline or diesel but use a cleaner, more economical alternative when natural gas is available. Since natural gas is stored in high-pressure fuel tanks, dual-fuel vehicles require two separate fueling systems, which take up passenger/cargo space.



Natural Gas Vehicles are growing in popularity in the US. Currently, Natural Gas Cars are in production in many European and South American countries. People are looking for alternative energy vehicles. Natural gas vehicles are gaining demand with about 120,000 NGV's on U.S. roads today and more than 15.2 million worldwide but are still way behind other alternative energy vehicles primarily because of the difficulty in refueling these vehicles. In recent years, companies have successfully driven natural gas vehicle use by building fueling stations and supplying natural gas under multi-year contracts to fleets at costs significantly less than the per-gallon cost of gasoline or diesel. Many companies have either purchased Natural Gas Vehicles or are converting their existing fleet to run on natural gas. With the increase in Fleet use, there are large companies with distribution outlets across the country issuing Request for Proposal to heavy-duty CNG Station Operators that are able to provide heavy-duty CNG fueling stations at or nearby their locations. Fleet use should lead to greater consumer use in the future.

Public transportation across the country has been using CNG for decades. Currently, about 12- 15% of public transit buses in the U.S. run on natural gas (either CNG – compressed natural gas or LNG – liquefied natural gas). That number is growing, with nearly one in five buses on order today slated to run on natural gas. States with the highest consumption of natural gas for transportation are California, New York, Texas, Georgia, Massachusetts and Washington, D.C.

In the U.S. alone, NGV's offset the use of nearly 360 million gallons of gasoline in 2011.

At present there **are limited natural gas stations available nationwide but are showing steady growth.** Refueling at a fast-fill CNG station takes no longer than tanking up with gasoline. As the fueling infrastructure builds for CNG, the inconvenience of limited public fueling opportunities is softened by the availability of filling up at home. There is at least one company that currently offers an in-home refueling station. This refueling appliance can be installed in a garage or outside a home to allow refueling using a home's natural gas supply. The refueling appliance requires an extended period of time to fill the fuel tank. In many cases, vehicles fueled up at favorable natural gas home rates can operate at a reduced rate per gallon than gas or diesel.

**Advantages & Disadvantage of CNG & LNG**

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Nearly 87% of U.S. natural gas used is domestically produced</li> <li>• 60-90% less smog-producing pollutants</li> <li>• 30-40% less greenhouse gas emissions</li> <li>• Less expensive than gasoline &amp; diesel</li> <li>• Convenient slow fill home fueling</li> </ul>	<ul style="list-style-type: none"> <li>• Limited vehicle availability</li> <li>• Less readily available than gasoline &amp; diesel</li> <li>• Fewer miles on a tank of fuel</li> <li>• Slow fill home fueling can take an extended period of time</li> <li>• Motor fuel tax billing for home refueling stations</li> </ul>

**PROPANE OR LIQUEFIED PETROLEUM GAS (LPG)** - a clean-burning fossil fuel that can be used to power internal combustion engines. LPG-fueled vehicles produce fewer toxic and smog-forming air pollutants. LPG is usually less expensive than gasoline, and most LPG used in U.S. comes from domestic sources.

**At this time only light-duty propane fleet trucks and vans are available with OEM (original equipment manufacturer); however LPG-fueled light duty passenger cars and trucks can be purchased in the U.S. from a dealer with prep-ready engine packages and be converted to run LPG.** In addition, gasoline and diesel vehicles can be retrofitted to run on LPG in addition to conventional fuel. The LPG is stored in high-pressure fuel tanks, so separate fuel systems are needed in vehicles powered by both LPG and a conventional fuel such as gasoline.



**Advantages & Disadvantage of LPG**

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• 85% of LPG used in U.S. comes from domestic sources</li> <li>• Fewer toxic and smog-forming air pollutants</li> <li>• Less expensive than gasoline</li> </ul>	<ul style="list-style-type: none"> <li>• No new passenger cars or trucks commercially available (vehicles can be retrofitted for LPG)</li> <li>• Less readily available than gasoline &amp; diesel</li> <li>• Fewer miles on a tank of fuel</li> </ul>

**ELECTRICITY** – While the EPA site does not list electricity as a fuel type, for purposes of this discussion it’s being covered. While some people think of the batteries in hybrid vehicles to be an example of electric vehicles, there are also vehicles which have on-board batteries and can be charged at an electricity source.

**Advantages & Disadvantage of Electricity (Plug-Ins)**

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Energy resilience and petroleum replacement</li> <li>• Greater fuel efficiency</li> <li>• Lower greenhouse gas emissions</li> <li>• Lower operating costs</li> </ul>	<ul style="list-style-type: none"> <li>• Cost, size, weight and disposal of batteries</li> <li>• Access to electrical outlets (apartment dwellers &amp; long distance travel)</li> <li>• Emissions shifted to electric plants</li> <li>• Electricity billing issues</li> </ul>

**HYDROGEN (H2)** - is being aggressively explored as a fuel for passenger vehicles. It can be used in fuel cells to power electric motors or burned in internal combustion engines (ICEs). It is an environmentally friendly fuel that can be produced domestically from several sources, reducing our dependence on petroleum imports. Several significant challenges must be overcome before it can be widely used.

**Advantages & Disadvantage of Hydrogen**

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Can be produced domestically from several sources</li> <li>• Environmentally Friendly</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive to produce</li> <li>• Limited availability</li> <li>• Limited vehicle availability</li> <li>• Cost of vehicle</li> <li>• Contains much less energy than gasoline</li> <li>• Danger from very high pressure, low temperature storage tanks</li> </ul>

Various costs, efficiencies, ability to be renewable and other benefits have increased use of these fuels. For example, ethanol, has public acceptance and is widely used, not only due to price and its ability to be renewable, but as an additive to gasoline as an oxygenate. The primary use is to reduce the production of carbon monoxide in the burning of the fuel. While the ester compound MTBE was previously used as an oxygenate, it has been found that it contaminates groundwater, especially during leaks of underground storage tanks, and states have moved to ban its use. A blend of gasoline and ethanol, usually E10, is used as a replacement for MTBE.



## FUEL TAX COMPLIANCE ISSUES

Given the various benefits of alternative fuels and their increasing development, the production, distribution, and sales of the fuel are of interest to those who collect taxes on the fuels and track their movements. With gasoline and diesel, the production process is relatively complex and costly when compared with alternative fuels. It would be difficult to refine gasoline in your back yard, but you could manufacture biofuels (including biodiesel) and ethanol in very small quantities for personal use. As we will also see it becomes more difficult to track electricity in plug-in vehicles, CNG in certain applications, and if hydrogen (fuel cell vehicles are developed) becomes widespread, gas that may be delivered in different methods.

**Ethanol** – the challenges with Ethanol stem in part from the inability to make bulk distribution through traditional liquid fuel pipelines. Thus, ethanol moves more on dedicated pipelines, rail cars, and by truck load. While these methods are certainly not difficult to track, most revenue and transportation agencies have not dedicated a lot of resources into tracking product moved that way, and as a result they may not know how much ethanol is moving into their state on rail cars, or even where the product might be loaded or unloaded. Another issue, that while somewhat difficult to quantify, but nonetheless can be a problem, is the fact that a number of ethanol manufacturers have not operated as fuel distributors and do not know the requirements for registering and reporting to the federal and state agencies. Since in some cases the production numbers are lower than gasoline or motor fuel distributors, the administrative agencies may not even be aware of their operations for some time. Attachment A shows a commercial business advertising equipment to make your own ethanol at home. Nowhere on the website is there a mention of motor fuel taxes.

**Biodiesel** – this is a term that can cover a wide range of liquids from vegetable oils and animal fats. Sources of the feed stocks can be soybeans and rapeseed (canola oil) but also include waste vegetable (“used French fry oil”) oils from restaurants, and in theory algae from water sources. It is evident that the sources of these fuels would make it very difficult in many cases, for the tracking of production and distribution of fuel. People not only make small batches of the fuel for personal use and limited distribution, but restaurants who used to have to pay to have waste oil removed, are glad to have it taken away at no cost or charging a small fee.

**Renewable Diesel:** The product is often interchanged with biodiesel. States need to have a clear understanding of which product is before them before any categorization occurs. The origin of the feedstock, plant or animal vs. crude, seems to be one determining factor for categorization. As well as the fact that renewable diesel meeting ASTM D975 standards is another.

**Compressed and Liquefied Natural Gas** – Conversion of CNG and LNG to GGE and DGE varies between states and the federal government which causes reporting issues for industry.

Each jurisdiction would need to determine how to collect the motor fuel taxes on the fuel dispensed into vehicles from refueling stations at an individual’s home. If your state does not require separate metering for the home fill units it will be difficult to determine gallons dispensed into a motor vehicle. While this is a limited application, it should challenge fuel tax administrators to think about what their answer will be when they get the phone call asking about how someone is going to pay fuel taxes. Will this be considered a retail location, and be subject to other state laws and regulations? Can similar issues crop up with other alternative fuels?

**Propane** – This also is a limited market and to this point it seems like propane is generally tracked and taxed by the proper agencies.

**Hydrogen** – Manufacture and widespread use of the vehicles are still in the future but depending on the delivery method of the fuel there will likely be many of the same issues that affect CNG and Propane.

**Electricity** – The obvious issue is that this fuel is not delivered as a liquid fuel and thus would have to be measured some other way if an effective method of taxation is used which will assess a tax based on the amount of product used. While the amount of energy in a gallon of gasoline (or other liquid fuel) can be computed for comparison to electricity and make for an assignment of an equal tax rate, the question becomes ‘What is the source of the electricity?’ If the vehicle can draw from the same source as regular household current, it would be impossible to compute the vehicle usage without some additional metering. Even with that



there would be the question of who tracks that portion of the electricity and how is the tax computed and paid. Some states have addressed this issue by having a registration fee in lieu of fuel taxes.

## WHAT SHOULD TAX ADMINISTRATORS BE DOING NOW?

The following issues are areas that should be considered in the area of accounting for alternative fuels:

**Are they in my state?** – While Ethanol and Biodiesel are fairly universal at this point, determine how much product is in your state, and how it gets there.

- Do you have a relationship with the railroads that may travel through your state?
- Is there a state or federal agency that may be able to give you that information?
- Are there fueling locations that may not otherwise be registered with your agency?
  - A suggestion would be to look at several websites, including trade groups who are always proud of their market penetration. Their list of retail locations that sell E85 probably will, but may not match the information you already have.
  - Did a farmer's co-op work to build an ethanol plant in your state and somehow no one ever registered it as a fuel manufacturing plant?
  - Is there an agency in your state that oversees chemical plants (state EPA)? You may check with them to make sure you know where they all are.

### Are people using the fuel in my state?

- Check with the Department of Motor Vehicles in your state to see if they can provide you with summary or detail information on the number of vehicles by fuel type. Fuel type may be determined by characters in the VIN, however this may not be a reliable or complete picture given the number of aftermarket conversions. You may find out that there may be 2 CNG vehicles registered to individuals but there may also be a large bus company with 150 CNG buses domiciled in your state.
  - Are you providing information about the registration and reporting requirements through your normal news outlets or through your agency website?
  - Anticipate the need for types of registrations and information about how people will have to track their usage and pay any taxes due. If someone walked into your office and said they had an electric vehicle, would you know what you would say to them?

### Education

The federal government is mandating that by 2017 there is to be 21 billion gallons of cellulosic biomass fuel produced. Do you even know what that is? How it is produced? How it is distributed? Do you know what fuel cells are and how they are used in a vehicle? Short of a change in the method of taxation for motor fuels, it is important to maintain an equitable method for collecting the proper taxes from every user. It doesn't make a lot of sense that the person driving a vehicle using regular diesel fuel should be paying fuel taxes while his next door neighbor is driving the same vehicle and using French fry oil from the fast food restaurant and not paying any taxes. What information do you have to track these fuels?

It is important to know not only what is out there, but what is on the horizon. You may wish to look on the internet for sites such as the EPA and various Department of Energy pages, including information on their Energy Information Administration portal. Talk to your neighboring states to see if they have information that you may wish to use or to see how they track the fuels.