

Current Report

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LPG -- THE LOWER COST FUEL?

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INTRODUCTION

During recent months the upward spiraling cost of gasoline and other liquid fuels has leveled off and even decreased a few cents in some cases. LPG (Liquified Petroleum Gas) is selling for considerably less than gasoline on a gallon basis and is attracting widespread interest as an alternate fuel for vehicles. It is estimated that eleven million vehicles will be converted to LPG operation within this decade. Some people still remember the rapid rise and fall of interest in LPG as a motor fuel which occurred some years ago and predict a similar fate for the current LPG "boom". Many industry officials and fuel supply analysts, however, view the current price differential as being more stable and likely to be favorable to LPG for as long as five to ten years.

Increases in world production of gas and petroleum have resulted in increased quantities of LPG on the market. In addition, LPG, which was previously wasted or "flared" in foreign oil production, is now being recovered for marketing. Since the use of LPG has not grown as rapidly as production, there is currently a "glut" of LPG which may continue for several years.

Improvements in equipment and installation-maintenance have occurred. Dependable, good quality, straight LPG and dual-fuel conversions are now available, some directly from the factory or dealer installed. Nevertheless, conversion to LPG involves a significant capital outlay and adherence to strict regulations governing the equipment and installation procedures.

WHAT IS LPG AND HOW IS IT PRODUCED?

LPG is a blend of naturally occurring products of petroleum refining. Approximately 65% of LPG is produced from gas wells, with the remaining 35% coming from oil wells. The thermal properties of propane and other common liquid fuels are shown in Table 1.

There is a significant difference in the heating capacity, or BTU (British Thermal Unit) content of LPG and gasoline. An engine converted to LPG will likely burn more gallons of fuel for the same work output than when powered by gasoline. The octane number for LPG is considerably higher than for gasoline, thus LPG provides resistance to the "pinging" observed in some engines under heavy load. LPG will boil at -44°F. This allows good fuel distribution in the intake manifold and even burning in the cylinder. Gasoline, on the other hand, is a blend of various components with different boiling points. This variation in boiling point can lead to uneven distribution during cold weather operation, and the accumulation of gum or varnish-like deposits within the fuel system, particularly if the engine sits idle for long periods of time. The difference in air/fuel ratio between gasoline and LPG results in a small decrease in maximum power when the engine is operated on LPG (unless modifications are made to the compression ratio, timing, etc.). Finally, the weight of LPG per gallon is considerably lower than for gasoline.

Table 1. Characteristics of some common fuels

Fuel	Energy Content BTU/Gal	Octane Number	Initial Boiling Point, °F	Final Boiling Point, °F	Air/Fuel Ratio For Complete Combustion	Density Lb/Gal
#2 Diesel	140,000	---	325-460	600-725	---	7.07
Gasoline (reg)	124,000	90	85-105	300-435	14.7:1	6.12
LPG	92,000	111	-44	---	15.7:1	4.25

WHAT ARE THE POTENTIAL SAVINGS IN USING LPG?

Potential yearly savings using LPG as a fuel are shown in Table 2. The Table takes into consideration the difference in BTU content of the fuel. The price of gasoline is assumed to be \$1.25 per gallon, with LPG at \$.70 per gallon. Purchase of a \$50 yearly tax exemption certificate has also been included.

The cost for converting a gasoline vehicle to a dual-fuel, gasoline-LPG vehicle is estimated to be between \$800 to \$1200. A recent sampling of conversion prices in the Tulsa and Oklahoma City areas showed the average cost for a conversion with a 100 gallon tank to be \$930. This figure does not reflect the differences in equipment installed at a quoted price. From Table 2, it can be seen that for a vehicle with an annual use of 3000 to 3500 gallons of gasoline, savings in switching to propane would pay for the system in one year. The conversion cost could be recovered in two years if the vehicle is currently using 1700 gallons of gasoline per year.

Much of the conversion cost can be recovered when the vehicle is sold, or the unit can be removed and installed on the replacement vehicle.

Approximately 50 to 60% of the conversion cost is in the price of the tank, 30 to 40% in carburetor and parts, and 10% in labor.

WHAT ARE THE ADVANTAGES OF AN LPG CONVERSION?

Although advantages claimed for LPG conversions differ from one expert to the next, most agree that the primary advantages are:

- *Engine maintenance requirements are reduced due to elimination of carbon and sludge de-

posits on spark plugs, valves, etc. Also, oil change intervals are sometimes increased since LPG does not contaminate or dilute engine lubricating oil.

- *A vehicle operating with an LPG conversion kit can easily be switched to operate on gasoline (the switch can be made while the vehicle is in operation).
- *Fuel pilferage is greatly reduced.
- *Polluting exhaust emissions are reduced.
- *Vehicle range prior to refueling is maintained or possibly increased.
- *LPG will continue to be in abundant supply according to industry spokesmen.
- *Conversion kits may be removed from vehicles being sold and installed on replacement vehicles.

WHAT ARE THE LIMITATIONS OF THE LPG CONVERSION?

There are also some negative aspects to LPG conversion. The most significant include:

- *Cost of the conversion.
- *LPG refueling operations are potentially hazardous. Since LPG is heavier than air, "bleeding" operations after refueling can be dangerous should a spark occur. "Freeze burns" can injure the inattentive person refueling the vehicle.
- *Refueling must be more carefully planned since propane outlets are not as numerous as gasoline outlets.
- *Depending upon fuel tank size, some space in the vehicle may be lost. Specially shaped tanks and mountings are available.
- *The price of LPG is not regulated, and thus might rise considerably if the demand were to suddenly increase.

Table 2. Fuel Savings-Propane Vs. Gasoline

Gallons Gas Used Annually	*Potential Savings in Fuel Cost
500	\$ 109.00
1000	\$ 267.00
1500	\$ 425.00
2000	\$ 583.00
2500	\$ 742.00
3000	\$ 897.00
3500	\$1,058.00
4000	\$1,217.00

***Assumes:**

- (1) Gasoline costs \$1.25/gallon.
- (2) Propane costs \$.70/gallon.
- (3) Tax permit costs \$50/year.
- (4) One gallon of propane will provide the same power as 0.75 gallons of gasoline.

WHAT KIND OF PERFORMANCE CAN BE EXPECTED?

In general, performance of a vehicle using LPG will be somewhat lower than that for gasoline. The loss in power is not noticeable during most driving, but may be as much as 10% during operations such as climbing a long grade. The loss of power is not considered a significant detriment. Part of the power loss is inherent in conversion to LPG fuel. However, much of the loss for dual-fuel systems occurs because emission control requirements state that a vehicle equipped for operation on gasoline cannot be altered with respect to emission control devices, ignition timing, etc. These regulations are necessary to insure compliance with air pollution minimums, but restrict engine adjustments for most efficient LPG operation. Vehicles which operate only on LPG can be specifically tuned, and often perform nearly as well as their gasoline counterparts. In this case, the efficiency with which LPG burns (97% as compared with 85% for gasoline) helps to make up the difference in BTU content. The high octane of the LPG helps to eliminate "pinging".

Several major automobile manufacturers are planning to equip some cars and trucks for LPG at

the factory. Engines in these vehicles will have 11:1 compression ratio, no catalytic converter, and will be tuned specifically for LPG. Some cars and trucks can now be purchased with this option. Many stationary engines used for power generation or pumping can be specified with LPG fueling. Some older tractors were also factory equipped for using LPG.

WHAT KIND OF EQUIPMENT IS REQUIRED?

A schematic diagram of the LPG conversion is shown in Figure 1. Only the LPG side of the fuel system is shown since the gasoline metering circuit remains unchanged except for the installation of an electric fuellock which turns off gasoline flow during LPG operation.

LPG is released from the storage tank as a liquid, and passes through a supply line to the filter and fuellock. The electric fuellock provides positive shutoff when LPG is not being used. In addition, most UL codes require installation of a vacuum switch which shuts off LPG flow when the engine is not running or being cranked for starting. This safety feature helps to insure fire protection.

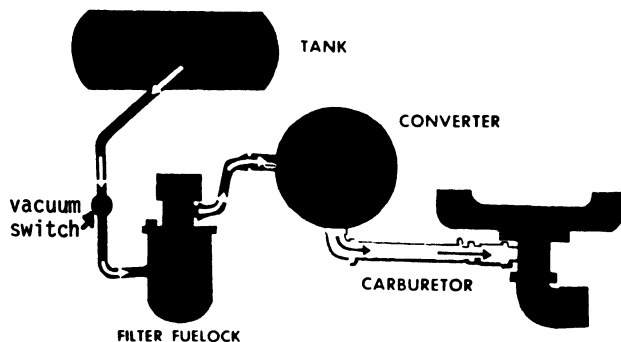


Figure 1. Typical Propane Fuel System

After passing through the fuellock, LPG enters the converter where it expands to a vapor, and line pressure is stepped down to about 5 psi. Hot water from the engine cooling system is circulated through a portion of the converter to counteract the refrigerating effect of rapid expansion of liquid to gas. The vapor then passes into the second stage of the converter and on to the carburetor where it is metered into the intake air stream.

When a dual fuel system is installed, the vehicle may be started on either fuel and switched from one to another whenever desired.

MUST THE VEHICLE BE OLD OR NEW?

Age of the vehicle has little to do with conversion to LPG provided parts can be found. The main requirement is that the engine be in good condition before conversion. This is critical to efficient fuel utilization for any engine. In some cases, the compression ratio of an engine may be too low to be efficiently used with LPG.

There are obvious advantages to ordering a new LPG equipped vehicle from the factory, or to have the dealer convert the vehicle before delivery. Since most factory installations are LPG only, the dual-fuel conversion would have to be made by the dealer, or at a shop specializing in such work.

WHAT LAWS AND REGULATIONS APPLY TO LPG SYSTEMS?

Most of the major components of an LPG conversion must be UL approved. These include the fuellock filter, converter, carburetor-mixer (if it is a pressure device), the tank, and the hoses, fittings, piping, etc. In addition to equipment regulations, there are safety regulations which apply to installation and attachment of components to the vehicle. These regulations may vary from one state to the next. When arranging for an LPG conversion, care should be taken to insure that all components and installation practices are within limits imposed by applicable regulations.

CAN I PERFORM THE CONVERSION MYSELF?

There is no law requiring that conversion to LPG be performed by a shop. However, because of the complexity in regulations governing equipment quality and installation practices, the safest and most practical approach would be to select a reputable shop with experience in such conversions. If a new vehicle is purchased with a conversion direct from the factory or dealer, such problems should be eliminated. As stated previously, only 10% of total conversion costs are for labor, so there may not be much opportunity for savings anyway.

WHERE CAN I GET MORE INFORMATION ON LPG CONVERSIONS?

General information on LPG and its many applications can be obtained from:

The Oklahoma Liquefied Petroleum Gas Association
2910 North Walnut
Oklahoma City, OK 73105
(405) 525-9386

Information on the local cost of installing LPG equipment can most likely be obtained from automobile dealers and shops specializing in conversions. Many LPG distributorships either perform such conversions or can provide information on reputable shops capable of doing the work.

Two of the major LPG equipment suppliers are:

Impco Carburetion, Inc.
16816 Gridley Place
Cerritos, California 90701
(213) 860-6666 or (213) 773-8885

and

Century LP-Gas Carburetion
Marvel-Schebler/Tillotson Division
Borg-Warner Corporation
2195 South Elwin Road
Decatur, Illinois 62525
(217) 428-4631

SUMMARY

Currently, there is a significant difference in the cost of gasoline and LPG fuel. For vehicles with relatively high levels of use, there is potential for significant savings in fuel cost by converting to straight LPG or dual-fuel use. The cost of converting a vehicle is approximately \$930 in Oklahoma. This cost could be recovered in one year if the vehicle is currently using 3000 gallons of gasoline

or more annually. Since LPG is not price regulated, it is difficult to forecast what the price will do over the coming years, though it is currently stable and many people within the industry forecast a continuing favorable price differential between the fuels.

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