

CHAPTER 6

Liquefied Petroleum Gas (LPG)

INTRODUCTION

Liquefied petroleum gas (LPG) is a term describing a group of hydrocarbon-based gases derived from crude oil and or natural gas. Natural gas purification produces about 55 percent of all LPG, while crude oil refining produces about 45 percent.

LPG is mostly propane, butane or a mix of the two. It also includes ethane, ethylene, propylene, butylene, isobutene and isobutylene; these are used primarily as chemical feedstocks rather than fuel.

LPG becomes a liquid at normal pressure and a temperature of -42°C , or at normal temperatures under a pressure of about eight atmospheres (standard units equivalent to ordinary atmospheric pressure at sea level and 0 degrees centigrade).

Separating the economic impact of LPG is problematic because it is derived from both oil and natural gas. A report commissioned by the propane industry estimated propane added \$3.8 billion to the Texas economy in 2002.

History

In 1910, Dr. Walter Snelling, a chemist with the U.S. Bureau of Mines, discovered that propane was a component of liquefied gas. Soon afterward, he discovered a means to store and transport propane and butane. Snelling received a patent for LPG in 1913, which he then sold to Frank Phillips, founder of Phillips Petroleum Company.¹

Initially, LPG was used to fuel metal-cutting torches, but by 1927, manufacturers were making gas cooking ranges fueled by LPG. Soon after World War II, propane was used as a transportation fuel in buses and cars.

Uses

LPG, primarily propane, is widely used as a fuel for heating and cooking in rural America and other areas where natural gas lines are unavailable. Its transportability and easy storage have boosted

its popularity. Although relatively few urban residences depend upon large propane tanks for heating and cooking, smaller tanks for outdoor grills are extremely common throughout the nation.

Propane also is used to generate electricity through microturbines and combined heat and power (CHP) technology. Microturbines are very small turbines intended to generate electricity for homes or commercial establishments, as well as for vehicles such as hybrid buses; they are still in the research and design stage. CHP, also known as cogeneration, produces electricity as well as heat for homes and businesses from a single fuel source.

While only 0.1 percent of LPG in 2005 was used for transportation, propane was nevertheless the most common alternative transportation fuel in the U.S., used by public transportation fleets as well as many state and federal agency vehicles.² Propane has a lower energy output than gasoline, producing 84,000 British thermal units (Btu) per gallon, or about 74 percent of gasoline's energy potential.³ The Texas Department of Transportation (TxDOT), which has the largest vehicle fleet in Texas state government, had 2,938 LPG-fueled vehicles in 2006, representing 28.5 percent of its fleet.⁴

LPG also ranks third in the U.S., behind gasoline and petroleum products, as a chemical feedstock.⁵

LPG IN TEXAS

Texas is the nation's largest producer and consumer of LPG. Chemical feedstock uses account for 90 percent of the state's LPG use, with nearly all of the remaining 10 percent used to produce energy.⁶ LPG used for transportation accounted for just 0.1 percent of all LPG consumed in Texas in 2005, and 1 percent in the U.S.⁷

Economic Impact

LPG production is intertwined with the oil and gas industries, and it is therefore difficult to separate them for the purposes of estimating

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EXHIBIT 6-1

Texas Average Employment and Wages for Industries
Related to Liquefied Petroleum Gas, Third Quarter 2007

Industry	Average Number of Employees	Total Wages
Crude Petroleum & Natural Gas Extraction	73,436	\$2,509,882,504
Natural Gas Liquid Extraction	3,728	116,232,357
Drilling Oil and Gas Wells	39,164	859,244,990
Support Activities, Oil/Gas Operations	81,741	1,510,925,468
Petroleum Refineries	21,308	591,346,879
Oil and Gas Field Machinery & Equipment	38,762	769,038,113
Petroleum Bulk Stations and Terminals	3,962	70,709,696
Other Petroleum Merchant Wholesalers	10,112	181,739,479
Pipeline Transportation of Crude Oil	3,833	89,218,207
Pipeline Transportation of Natural Gas	9,884	276,698,172
Refined Petroleum Product Pipeline Operations	255	4,900,710
All Other Pipeline Transportation	61	957,697

Sources: Texas Comptroller of Public Accounts and Texas Workforce Commission.

LPG's economic impact. **Exhibit 6-1** lists average employment and wages in the third quarter of 2007 for a series of industries linked to LPG. In the third quarter of 2007, there were about 3,021 Texas LPG dealers who earned a total of \$31.9 million.⁸

A 2004 report commissioned by the National Propane Gas Association examined the impact of propane on the U.S. and state economies. **Exhibit 6-2** shows the estimated direct economic impact of the propane industry on the U.S. and Texas economies in 2002.⁹

EXHIBIT 6-2

Direct Value Added by the Propane Industry, 2002
(in Millions)

Sector	U.S.	Texas
Production	\$2,977.1	\$959.7
Transportation, Storage and Wholesaling	465.5	86.5
Retailing	6,121.5	444.3
Total	\$9,564.0	\$1,490.6

Note: Totals may not add due to rounding.
Source: National Propane Gas Association.

Consumption

Texas consumed 413.5 million barrels of LPG for fuel in 2005, 55.8 percent of all LPG consumed in the U.S. The state's industrial sector was the largest consumer, accounting for 97.3 percent of all Texas consumption and 71.2 percent of national consumption.¹⁰

Exhibit 6-3 details Texas LPG energy consumption by sector.

In 2002, Texas consumption of propane was spread among the following uses, ranked by volume: industrial (30 percent), residential (29 percent), commercial (22 percent), internal combustion (7 percent), farm (6 percent) and cylinders used for grills and camping (5 percent).¹¹

Again, propane is the most commonly used alternative fuel for transportation. In 2006, Texas had 525 LPG fueling stations, or 22.9 percent of the national total. By contrast, Texas has about 16,500 gasoline fueling stations.¹²

LPG vehicles registered in Texas must display a prepaid "Liquefied Gas Tax" decal based on vehicle gross weight and the amount of miles driven during the previous year. **Exhibit 6-4** shows the number of



EXHIBIT 6-3

Texas LPG Consumption, Price and Expenditures by Sector, 2005

	Residential	Commercial	Industrial	Transportation	Total
Consumption (in thousands of barrels)	8,996	1,587	402,436	468	413,487
Consumption (in trillions of Btus)	32.6	5.7	1,456.8	1.7	1,496.8
Prices (in dollars per Million Btu)	\$22.5	\$18.1	\$12.0	\$21.7	\$12.2
Expenditures (in \$millions)	\$733.0	\$103.8	\$17,416.7	\$36.8	\$18,290.0

Source: U.S. Energy Information Administration.

registered LPG vehicles in Texas from 2000 through 2006. Texas school districts and counties, the federal government and nonprofit telephone and electrical cooperatives are exempt from this tax and therefore are not included in the count of registered vehicles.

The number of registered Texas vehicles using LPG as a fuel source has been decreasing in recent

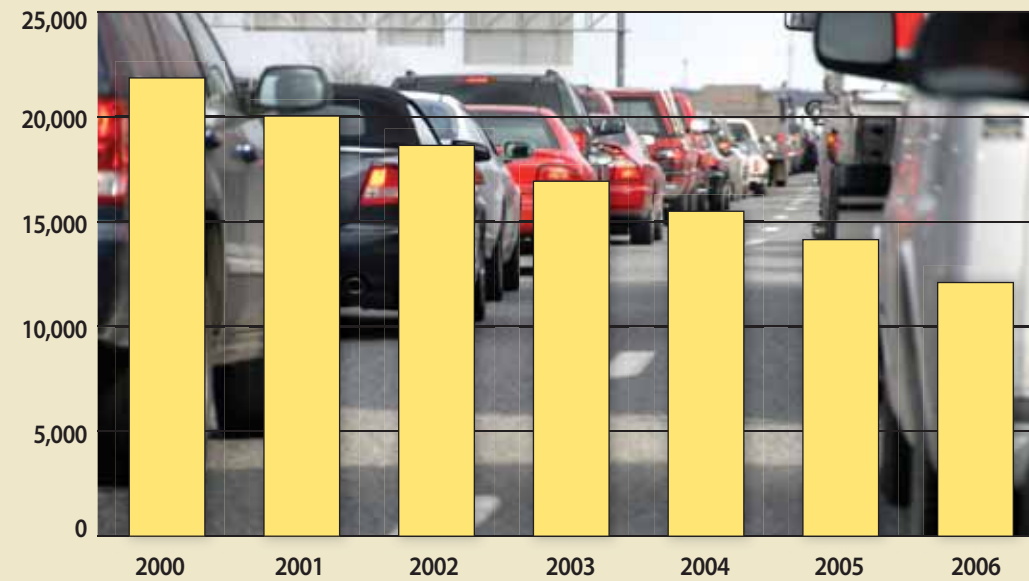
years, dropping by 9,753 vehicles or 44.6 percent from 2000 to 2006.¹³

The federal Energy Policy Act of 1992, which required state governments to acquire light-duty vehicles powered by alternative fuels, spurred the popularity of LPG-fueled vehicles in state fleets. At that time, 221,000 of 250,000 alternative

EXHIBIT 6-4

Non-Exempt LPG Vehicles in Texas, 2000-2006

Vehicles



Source: Texas Comptroller of Public Accounts.

vehicles in the U.S., or 88.4 percent, were fueled by propane. Beginning in 1997, the act required 10 percent of new light-duty vehicles purchased by state governments to be fueled by alternative fuels and increased each year, from 15 percent in 1998 to 25 percent in 1999, 50 percent in 2000 and 75 percent from 2001 onward.¹⁴

Many state fleets, however, are shifting away from propane as other alternative fuels become available; and because of slow sales, some equipment manufacturers have stopped producing and selling LPG vehicles, which has contributed to the decreased size of LPG fleets. TxDOT has stated, moreover, that it is not comfortable with after-market conversions of gasoline-powered vehicles to LPG, and that this industry too, has declined.¹⁵ The limited number of LPG fueling stations in Texas, moreover, requires TxDOT to maintain its own fueling stations.

The Texas state government fleet had 7,398 vehicles using alternative fuels in fiscal 2006, with LPG vehicles accounting for 73 percent of the total.

But the Office of Vehicle Fleet Management at the Comptroller's office has reported that the number of LPG vehicles in use is decreasing while the number of vehicles using other alternative fuels, such as ethanol, electric and hybrid options, is rising.¹⁶

In TxDOT's fleet, the state's largest, the number of LPG vehicles employing either an LPG and gasoline mix or 100 percent LPG has fallen precipitously (**Exhibit 6-5**). In fiscal 2001, TxDOT's fleet included 4,677 LPG vehicles, which remained relatively stable until 2004. By fiscal 2006, this portion of the fleet had dropped by 1,739 or 37.2 percent, to 2,938.¹⁷

Production

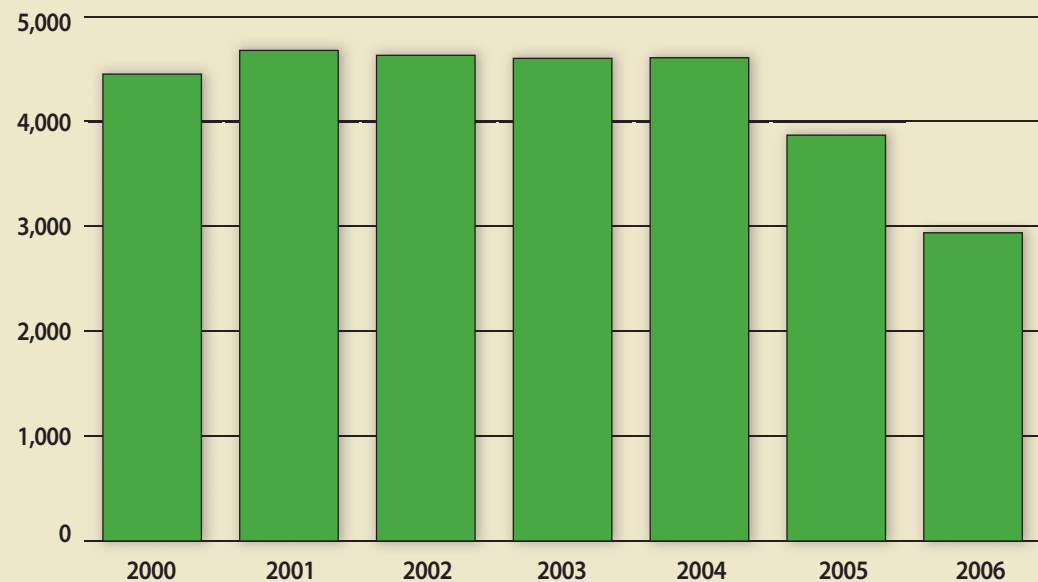
In 2002, Texas produced 3.5 billion gallons of propane, or 36 percent of the national total.¹⁸

LPG is separated from crude oil at petroleum refineries and from natural gas at processing plants. Oil refineries create LPGs as a byproduct of gasoline and heating oil production. At natural gas process-

EXHIBIT 6-5

TxDOT Active Fleet of LPG Vehicles, 2000-2006

Vehicles



Source: Texas Department of Transportation.

ing plants, LPGs are extracted from the gas to prevent them from condensing and causing problems with natural gas transportation in pipelines.

Propane is transported by underground pipelines or by railroad to storage terminals and by trucks to storage facilities, residential homes and businesses (**Exhibit 6-6**).

Propane is stored in large tanks at various distribution points, and in smaller tanks at residential homes. Residential demand for propane tends to be seasonal, and propane and other LPGs can be stored whenever supply exceeds demand. Propane inventories often are built up during the summer months for use in the winter.

Availability

Because LPG is a byproduct of oil and gas, the amount available is directly tied to the amount of oil and gas available. Texas’ crude oil reserves in 2006 represented almost one-fourth or 23.3 percent of total proven U.S. reserves.¹⁹ Natural

Gas reserves in Texas represented an even higher proportion of total reserve than did oil. Texas’ proven reserves in 2006 accounted for 29.2 percent of all proven natural gas reserves in the U.S.²⁰

COSTS AND BENEFITS

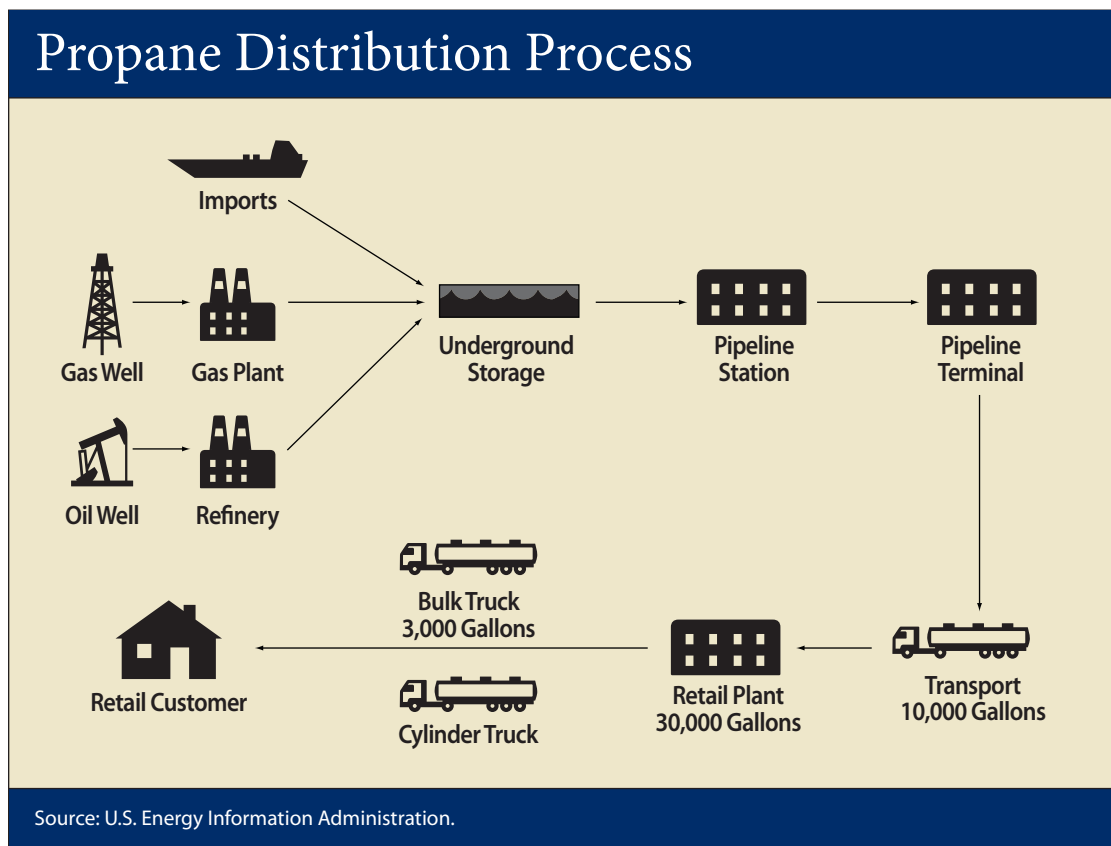
While propane is produced from both crude oil refining and natural gas processing, its price is more influenced by the cost of crude oil because propane competes mostly with oil-based fuels.²¹

Weather, inventory levels and production all help determine LPG prices. As of January 8, 2007, residential propane cost \$1.99 per gallon, while wholesale propane cost 96 cents per gallon. By March 17, 2008, the cost of residential propane had risen to \$2.60 per gallon, while the wholesale price climbed to \$1.63.²²

Environmental Impact

LPG is a non-renewable fuel source, as is the natural gas and crude oil from which it is produced.

EXHIBIT 6-6



Propane’s price is influenced by the cost of crude oil because propane competes mostly with oil-based fuels.

Source: U.S. Energy Information Administration.

LPG is a cleaner alternative to many fuels, but its combustion does produce pollutants. These include particulate matter, sulfur dioxide, nitrogen oxides, nitrous oxide, carbon monoxide, carbon dioxide, methane and non-methane total organic carbon.²³

LPG vehicles emit around a third less reactive organic gas, which reacts with other pollutants in sunlight to create ozone, and about 50 percent less of the vapors that create smog, than do gasoline vehicles. LPG vehicles also release 20 percent less nitrogen oxide and 60 percent less carbon monoxide than gasoline vehicles. Finally, LPG contributes very little to acid rain because of its low sulfur content.²⁴

Again, since LPG is a byproduct of oil and natural gas production, its water consumption and quality implications are similar to those of oil and gas. More information on oil and gas can be found in Chapters 4 and 5.

Other Risks

There are federal and state regulations on the production, transportation and storage of LPGs and other pressurized gases to minimize risks. Though rare, LPG, particularly propane and butane, poses a risk of sudden depressurization and explosions during storage and transport.²⁵

State and Federal Oversight

The Texas Railroad Commission (RRC) administers and enforces state laws and rules related to LPG. RRC also licenses LPG activities in the state including its sale, transportation and storage; the manufacture, repair, sale and installation of LPG containers; and the installation, servicing and repair of LPG-fueled appliances.

Drivers and dealers of LPG vehicles also must obtain a fuels tax permit from the Texas Comptroller of Public Accounts.

While most regulation of LPG is conducted at the state and local levels, two federal agencies also have related oversight responsibilities. The U.S. Environmental Protection Agency is responsible for oversight and regulation of emissions and clean air standards, while the U.S. Department of Transportation regulates the transportation of LPG.

Subsidies and Taxes

LPG and other alternative fuels receive a number of subsidies and incentives from the federal and state governments. The most important of these is the federal motor fuel excise tax credit, which provides a 50 cent per gallon tax credit for alternative fuels, including LPG.

Because LPG is derived from oil and natural gas, its production also is affected by taxes and fees assessed on those resources. More information on subsidies for oil and gas, which affect LPG, can be found in Chapter 28. In addition, some taxes and fees apply directly to LPG.

Liquefied Gas Tax

Texas taxes LPG used in motor vehicles on public highways at a rate of 15 cents per gallon.²⁶ The state's gasoline tax, by contrast, is 20 cents per gallon. In fiscal 2007, the state collected more than \$1.2 million through the LPG tax.²⁷ This was 17.1 percent less than in the year before and 41.9 percent less than in fiscal 2000 (**Exhibit 6-7**).

LPG Delivery Fees

Texas also imposes an LPG delivery fee on the first sale of LPG. The purpose of this fee is to provide funding to the Texas Railroad Commission's Alternative Fuels Research and Education division. Each person responsible for collecting and remitting a fee on the delivery of LPG into any cargo container

LPG is a cleaner alternative to many fuels.

EXHIBIT 6-7

State Revenue Generated from the Liquefied Gas Tax, Fiscal 2000-2007

Fiscal Year	Liquefied Gas Tax	Percent Change
2000	\$2,136,722	-
2001	\$1,853,029	-13.3%
2002	\$1,858,316	0.3%
2003	\$1,572,057	-15.4%
2004	\$1,586,076	0.9%
2005	\$1,523,432	-3.9%
2006	\$1,498,838	-1.6%
2007	\$1,242,464	-17.1%

Note: State fleets are NOT exempt.
Source: Texas Comptroller of Public Accounts.

must collect fees from the purchaser ranging from \$7.50 for small containers up to \$25 per increment of 5,000 gallons for containers capable of holding 12,000 gallons or more.²⁸

In fiscal 2007, these fees yielded nearly \$2.5 million for the state.²⁹ This was 29.7 percent more than in fiscal 2006 and 25.3 percent more than in fiscal 2000 (**Exhibit 6-8**).

OTHER STATES AND COUNTRIES

As noted earlier, Texas is the nation’s largest consumer of LPG for all sectors combined. Other states, however, exceed Texas in some sectors. Texas was the second-largest consumer of residential LPG in 2005, accounting for 6.3 percent of the nation’s total; Michigan led the states with 9.7 percent.

Similarly, Texas was the second-largest consumer of commercial LPG in 2005, again accounting for 6.3 percent of the nation’s total commercial use. Michigan was again first, with 9.7 percent of the national total.

Texas was the largest consumer of industrial LPG in the nation in 2005, accounting for nearly three-quarters (71.2 percent) of all industrial LPG used in the nation. Louisiana (8.5 percent) was a distant second.

Finally, Texas was the fourth-largest consumer of LPG used for transportation in 2005, accounting for 6.4 percent of the nation’s LPG used for this purpose. North Carolina was the largest with 17 percent, followed by California and Michigan with 11.5 percent and 6.9 percent respectively.³⁰

While few automakers offer LPG vehicles in the U.S., they are much more common in Europe and Australia. Ford and GM both offer LPG-fueled models to those markets. The popularity of these vehicles is due to tax incentives for purchasing LPG and/or tax disincentives for gasoline.³¹

OUTLOOK FOR TEXAS

As noted above, LPG for transportation has seen its market share fall in recent years. While a number of state and federal incentives encourage the use of LPG, Texas and the U.S. as a whole seem to be moving toward other alternative fuels such as ethanol. Falling sales of LPG vehicles have prompted manufacturers to curtail their production.

LPG as a source of heating and cooking fuel will continue to be common in Texas. Whether its use is for outdoor grilling or as a substitute for natural gas in rural areas, LPG is accessible and affordable.

ENDNOTES

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While few automakers offer LPG vehicles in the U.S., they are much more common in Europe and Australia.

EXHIBIT 6-8

State Revenue Generated from LPG Delivery Fees, Fiscal 2000-2007

Fiscal Year	Liquefied Gas Delivery Fees	Percent Change
2000	\$1,956,752	-
2001	\$2,167,909	10.8%
2002	\$2,099,462	-3.2%
2003	\$2,359,833	12.4%
2004	\$2,112,984	-10.5%
2005	\$1,965,716	-7.0%
2006	\$1,890,508	-3.8%
2007	\$2,451,651	29.7%

Source: Texas Comptroller of Public Accounts.

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 - 13 Interview with Dan Kelly, director of Alternative Fuels Research and Education Division, Texas Railroad Commission, June 13, 2007; and Texas Comptroller of Public Accounts, “Statistics for 0601 to 0612”, Austin, Texas, June 14, 2007. (Computer printout.)
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 - 15 Interview with Don Lewis, fleet manager, Texas Department of Transportation, Austin, Texas, June 11, 2007.
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