



# FACTS ABOUT PROPANE

*America's Exceptional Energy*

## PROPANE INDUSTRY

Propane, the most common liquefied petroleum gas (LP-gas), is one of the nation's most versatile sources of energy and supplies about 4 percent of our total energy needs.

Propane exists as a liquid and a gas. At atmospheric pressure and temperatures above  $-44$  F, it is a non-toxic, colorless and odorless gas. Just as with natural gas, an identifying odor is added so it can be readily detected. When contained in an approved cylinder or tank, propane exists as a liquid and vapor. The vapor is released from the container as a clean-burning fuel gas. Propane is 270 times more compact as a liquid than as a gas, making it economical to store and transport as a liquid.

Approximately 90 percent of the United States' propane supply is produced domestically, while 70 percent of the remaining supply is imported from Canada and Mexico. Approximately equal amounts of propane come from the refining of crude oil and from natural gas processing. Thus, propane is a readily available, secure energy source whose environmental benefits are widely recognized. Propane is an approved, alternative clean fuel listed in the 1990 Clean Air Act, as well as the National Energy Policy Act of 1992.

## USES OF PROPANE

This remarkable fuel serves approximately 60 million people in the United States. In 1999, 19.6 billion gallons of propane were consumed in the U.S. as follows:

- 8 billion gallons for residential/commercial/recreational usage.
- 0.4 billion gallons for internal combustion engine usage.
- 9.8 billion gallons for chemical, industrial and utility usage.
- 1.4 billion gallons for other uses, including such agricultural applications as grain drying and flame cultivation.

## **IN THE HOME**

Consumers use propane for heating and cooling homes, heating water, cooking, refrigeration, drying clothes, barbecuing, lighting, and relaxing in front of the gas fireplace. According to the 1997 *Residential Energy Consumption Survey* report published by the U.S. Department of Energy's Energy Information Administration (EIA):

- 8.1 million households use propane, and 4.6 percent of these homes use propane as their main heating source.
- Of the nation's 6.3 million mobile/manufactured homes, 16 percent use propane as the main heating fuel.

## **AS AN ALTERNATIVE FUEL FOR VEHICLES**

Propane gas is the most widely used alternative fuel, with nearly 4 million vehicles worldwide running on propane. More than 350,000 vehicles run on propane in the U.S., according to the U.S. Department of Energy's Alternative Fuels Data Center.

- The Alternative Fuels Data Center documents 4,175 public propane refueling stations (more than three times as many as any other alternative fuel), and industry estimates range to 10,000 or more. There is also an established network of licensed propane conversion centers throughout the country.
- Propane-powered vehicles offer the best combination of durability, performance and driving range.
- Propane's low pollution characteristics make it a safe choice for more than 300,000 forklift truck operators and other indoor industrial vehicle operators.
- It is a popular and safe fuel for business and municipal fleets across the United States. More than 80,000 bus, taxi and delivery services, and other fleets are fueled by propane. U.S. automobile and truck manufacturers are producing more and more vehicles equipped with propane-powered engines to keep pace with this growing demand.

## **FOR RECREATIONAL USE**

Because propane is portable and clean-burning, it is used by millions of recreational vehicle owners and camping enthusiasts.

- Gas grills, outdoor gas lights, mobile home and RV appliances, generators, and greenhouse heaters can all be fueled by propane.
- Millions of people are already using propane to safely and economically fuel heaters for their swimming pools, saunas, patios, and whirlpools.

- Because they are easier to use and better for the environment, gas grills are becoming ever more popular with the American public. According to 1999 statistics, 75 percent of all U.S. families own a barbecue grill, and 60 percent of these grill owners use a propane gas grill. Also, in 1999, manufacturers shipped a total of 14.9 million propane gas grills to retailers.

## **ON THE FARM**

Propane is a staple on 660,000 farms, where it is used in a wide range of agricultural applications:

- Crop drying—corn, soybeans, grains, tobacco, apples, peanuts, onions and other crops.
- Flame cultivation—controlling weed growth using propane burners.
- Fruit ripening.
- Space heating—for barns, pig farrowing houses, chicken houses, stock tanks, nurseries, greenhouses, orchards, and incubators.
- Water heating—for dairies and stock watering tanks.
- Refrigeration of foods.
- Running a variety of farm engines, including tractors, weeders, irrigation pumps, stand-by generators, and seedling planters.

## **COMMERCIAL AND INDUSTRIAL USES**

More than 1 million commercial establishments, such as hotels, restaurants and laundromats use propane in the same way a homeowner does: for heating and cooling air, heating water, cooking, refrigeration, drying clothes, barbecuing, and lighting. More than 350,000 industrial sites rely on it for space heating, brazing, soldering, cutting, heat treating, annealing, vulcanizing, and many other uses. Petrochemical industries use propane in the manufacture of plastics.

## **HISTORY OF PROPANE**

In 1910, a Pittsburgh motor car owner walked into chemist Dr. Walter Snelling's office, complaining that the gallon of gasoline he had purchased was half a gallon by the time he got home. Consumers were being cheated, he said, because the gasoline was evaporating at a rapid and expensive rate, and he asked Dr. Snelling to investigate. Dr. Snelling took up the challenge. Using coils from an old hot-water heater and other miscellaneous pieces of laboratory equipment, he built a still that could separate the gasoline into its liquid and gaseous

components and discovered that the evaporating gases were propane, butane and other hydrocarbons.

People soon discovered the value of this wonderful new fuel. By 1912, the first propane gas stove was cooking food in the home. The first propane-powered vehicle ran in 1913, and, by 1915, propane was being used in torches to cut through metal. By 1920, propane was marketed for flame cutting and cooking applications. In 1927, total sales of propane in the United States exceeded 1 million gallons.

By the 1930s, the Compressed Gas Association (CGA) established and proposed a set of recommendations to the National Fire Protection Association (NFPA). In 1932, the first pamphlet of standards (No. 58) was adopted for publication. Known as the Liquefied Petroleum Gas Code, or NPFA 58, this standard is still in use today, having been adopted by most states as the basis for their regulations.

After World War II, as the nation's population grew and its economy expanded, annual sales of propane gas increased to more than 15 billion gallons. Today, propane gas is an \$8 billion industry in the United States alone and is still growing.

## TRANSPORTATION OF PROPANE

As the demand for propane grew, a vast transportation network was created. After crude oil and petroleum gases are extracted from the earth, they are shipped to an oil refinery or natural gas processing plant, respectively, where propane is one of many products that can be separated from the raw hydrocarbon stream.

From the refinery or processing plant, propane is shipped in two stages—first, to an intermediate terminal and from there to the local propane supplier for delivery to the end user. All propane is transported under pressure in its more compact liquid form; 75 percent is transported by a pipeline-truck combination.

Two types of trucks are used for propane transportation: a highway transport (which typically carries 7,000 to 12,000 gallons) and a smaller bulk delivery truck, called a "bobtail" (which carries 1,000 to 5,000+ gallons). Both types of trucks are constructed of high-strength steel. Today this transportation network includes . . .

- 90 barges and tankers.
- 6,000 transports.
- 13,500 bulk/storage distribution points.
- 36,500 bobtails.

- 22,000 railroad tank cars.
- 70,000 trunk line miles in the pipeline system.
- 162,000 cylinder refillers (hardware stores, gas stations, campgrounds, etc.).

Propane transportation is regulated by the U.S. Department of Transportation (DOT). DOT requires that all shipping papers contain a 24-hour-a-day telephone number where emergency assistance and information can be obtained. This service must be able to provide information about any cargo that is classified by DOT as a hazardous material. There are several sources in the United States that an emergency response crew leader can contact in the case of a transportation accident. The following agencies can provide more information:

*CHEMTREC*  
(800) 262-8200  
[www.chemtrec.org](http://www.chemtrec.org)

*PERS - Professional Emergency Resource Services*  
(800) 728-2482  
[www.pers-er.com](http://www.pers-er.com)

*Infotrac*  
(800) 535-5053  
[www.infotrac.net](http://www.infotrac.net)

*Chem-tel Inc.*  
(813) 248-0573  
[www.chemtelinc.com](http://www.chemtelinc.com)

## STORAGE OF PROPANE

Retail propane storage facilities are known in the propane industry as "bulk plants." In the United States, there are 13,500 bulk plants that contain one or more propane tanks, with typically 18,000 to 30,000 gallons storage capacity each. Bulk propane storage tanks are constructed of steel in accordance with the Boiler and Pressure Vessel Code, Section VIII of the American Society of Mechanical Engineers (ASME) and the requirements of state and municipal authorities. The tanks are equipped and located as set forth in NFPA 58, "Liquefied Petroleum Gas Code." Each storage tank, depending on size, is set a specific distance away from other tanks, buildings, and property lines.

- Bulk storage tanks are always installed on a firm foundation and are protected by an enclosure to prevent trespassing and tampering.
- Tanks are painted light, reflective colors for both safety and appearance.

## SAFETY COMES FIRST

The U.S. propane industry has a proud safety record, with equal emphasis on the adoption of sound engineering principles, up-to-date employee training, and educating consumers on the safe use of propane. The industry's safety record has been praised in the *Congressional Record*, and such organizations as the National Fire Protection Association, the U.S. Chemical Safety Board, and the

International Association of Fire Chiefs have public acknowledged the propane industry's commitment to safety.

## **STORAGE AND TRANSPORTATION SAFETY**

### **Transferring Propane Safely from Truck to Tank**

Pumps are used to transfer propane from the tank truck to the consumer storage tank. Various valves and accessories are required by NFPA 58 and the U.S. Department of Transportation to enhance the safety of the transfer operation. The following safety valves are typically found on containers or used during the transfer of liquid propane to residential storage systems:

- **Pressure Relief Valves**—Propane tanks are protected by pressure relief valves that open and close to prevent excessive internal pressure due to abnormal conditions.
- **Excess Flow Valves**—These valves can be found on the storage tank, the loading facility known as the “bulk head” and on the delivery vehicle. They provide protection during product transfer or anytime that propane flows through them, including during normal operating periods. Should the flow of propane exceed the valve's setting, which might occur if the piping downstream of the valve is broken, the valve will automatically close and shut off the flow of propane.
- **Line Valves**—These manually operated valves are used to control flow into or out of the system or to isolate piping for maintenance purposes. Other valves are used with bulk storage tanks and tank trucks where special attention and protective measures are needed.
- **Remote Shutoff Systems**—New bobtail delivery trucks, and by 2006 all existing bobtail trucks, will be equipped with radio-controlled systems or other DOT-approved systems that can shut off the main truck valve and the truck's engine if the operator detects a leak in the system.
- **Passive Shutoff Systems**—New propane transports and as of July 1, 2001, requalified existing transports, will be protected with a “passive” product control system that will automatically stop the flow of propane if a line separation occurs.

The Chemical Transportation Emergency Center (CHEMTREC) is operated by the Chemical Manufacturers Association in Arlington, Virginia. CHEMTREC is a public service that provides 24-hour telephone service, seven days a week, to supply emergency response information and coordinate shipper and carrier efforts in coping with transportation accidents involving hazardous materials.

In 1981, the Department of Energy released a report containing an analytical examination of fatal accidents involving propane gas transportation and storage

between 1971 and 1979. The purpose of the investigation was to assess the risks associated with propane storage and transportation.

According to this report, the individual risk is about one death per 37 million persons; about the same as the risk of a person on the ground being killed by an airplane crash, and much less than the risk of death by lightning, tornadoes, or dam failures.

See the following table for a summary of average annual fatalities and individual risk comparisons contained in the report titled, "LPG Land Transportation and Storage Safety."

### **AVERAGE ANNUAL FATALITIES AND INDIVIDUAL RISK COMPARISONS**

<b>EVENT</b>	<b>AVERAGE FATALITIES</b>	<b>INDIVIDUAL RISK*</b>
<b>Voluntary Risk</b>		
Motor Vehicle Accident	46,700	1 in 4,700
Air Crashes (persons in plane)	1,552	1 in 140,000
<b>Involuntary Risk</b>		
Lightning	160	1 in 1,375,000
Tornadoes	90	1 in 2,450,000
Dam Failures	35	1 in 6,300,000
Air Crashes (persons on ground)	6**	1 in 37,000,000
LPG Transportation/Storage Accidents	6**	1 in 37,000,000

\* Based on U.S. population of 222,000,000.

\*\* Applies only to members of the general public, i.e., persons at the scene of the accident through coincidence or curiosity.

*(Table S-2: Department of Energy "LPG Land Transportation and Storage Safety," December 1981)*

### **SAFETY TRAINING AND EDUCATION**

To further enhance the industry's safety and service, a number of training programs and efforts have been implemented throughout the country.

## For Propane Industry Personnel

In keeping with the industry's high safety standards, NPGA has developed the Certified Employee Training Program (CETP), which provides service personnel with a complete technical training curriculum. The areas covered include:

- Basic Principles & Practices
- Propane Delivery
- Plant Operations
- Distribution System Operations
- Transfer System Operations
- Appliance Installation
- Appliance Service
- Large Equipment Connection & Service



Important industry references such as ANSI Z223.1/NFPA 54, "The National Fuel Gas Code," and NFPA 58, "Liquefied Petroleum Gas Code" are utilized in the development of this material.

Each year, thousands of industry employees and firefighters attend service and safety schools sponsored by the industry. The sessions provide important training in the methods of quickly controlling and safely handling a propane emergency. The award-winning *Propane Emergencies* program was created to provide a uniform curriculum to help America's emergency responders and firefighters develop the knowledge and skills necessary to safely and effectively manage a propane emergency in transportation or at fixed facilities. Visit [www.propanesafety.com](http://www.propanesafety.com) for more information.

## For Homeowners

Home appliances and fuel systems need regular check-ups to keep them running properly, just as automobiles do. That is why the National Propane Gas Association (NPGA) developed the Gas Appliance System Check (GAS Check®) program. This national safety program was designed to reduce the chances of residential accidents involving propane gas. A GAS Check® inspection allows service personnel to explain in everyday terms the safety features of gas appliances. The service technician checks the entire propane system for leaks and makes sure that every element satisfies local regulations and industry standards. The technician also familiarizes homeowners with the distinctive smell of propane and provides other important safety information.



If there is any worn or damaged equipment that should be replaced, the consumer is informed and advised of the options for correcting the problem or improving the system. The GAS Check® technician also provides instructional materials and advises the consumer about the most efficient and safest way to operate the propane system. The GAS Check® program has been so successful that it is nationally recognized as an important home safety program. The National Fire Protection Association awarded GAS Check® its Organization Member Award in 1985 for the best example of a public fire safety program.



## **NATIONAL PROPANE GAS ASSOCIATION**

Founded in 1931, the National Propane Gas Association (NPGA) is the only national trade association for the U.S. propane gas industry. With a membership including both small, family-owned businesses and large, multi-state corporations, NPGA represents every segment of the industry—retail marketers of propane gas and appliances; producers and wholesalers of LP-gas; appliance and equipment manufacturers and distributors; tank and cylinder fabricators; transporters; and consultants. In addition to 3,700 U.S. member companies, NPGA membership includes international members from 28 countries. Governed by an elected Board of Directors, NPGA develops programs and activities through its Executive Committee and seven standing committees.

### **MISSION**

NPGA's mission is to promote the safe and increased use of propane, to work for a favorable environment for production, distribution and marketing, and to serve as the principal voice of the propane industry.

### **STRATEGIC INITIATIVES**

- To promote safety in the propane industry.
- To achieve favorable governmental actions on propane issues.
- To provide forums for communication within the industry.
- To anticipate and respond to challenges and opportunities that face our industry and members.

**APPENDIX**

**Approximate Properties Of LP-Gases  
(Commercial Propane)**

Specific gravity of liquid at 60 degrees F	0.504	Latent heat of vaporization at boiling point:	
Initial boiling point at 14.7 psia, degrees F	-44.0	(a) Btu per pound	184
Weight per gallon of liquid at 60 degrees F, lb	4.20	(b) Btu per gallon	773
Specific heat of liquid, Btu/lb. At 60 degrees F	0.630	Total heating values after vaporization:	
Cubic ft. of vapor per gallon at 60 degrees F	36.38	(a) Btu per cubic foot	2,488
Cubic ft. of vapor per pound at 60 degrees F	8.66	(b) Btu per pound	21,548
Specific gravity of vapor (air=1) at 60 degrees F	1.50	(c) Btu per gallon	91,502
Ignition temperature in air, degrees F	920-1120	Molecular weight	44.094
Maximum flame temperature in air, degrees F	3,595	Chemical formula	C <sub>3</sub> H <sub>8</sub>
Limits of flammability in air, Percent of vapor in air-gas mixture:		Vapor pressure in psig	
		70 degrees F	127
(a) Lower	2.15	100 degrees F	196
(b) Upper	9.60	105 degrees F	210
		130 degrees F	287

NFPA 58, *Liquefied Petroleum Gas Code, 1998 Edition, Table B-1.2*

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