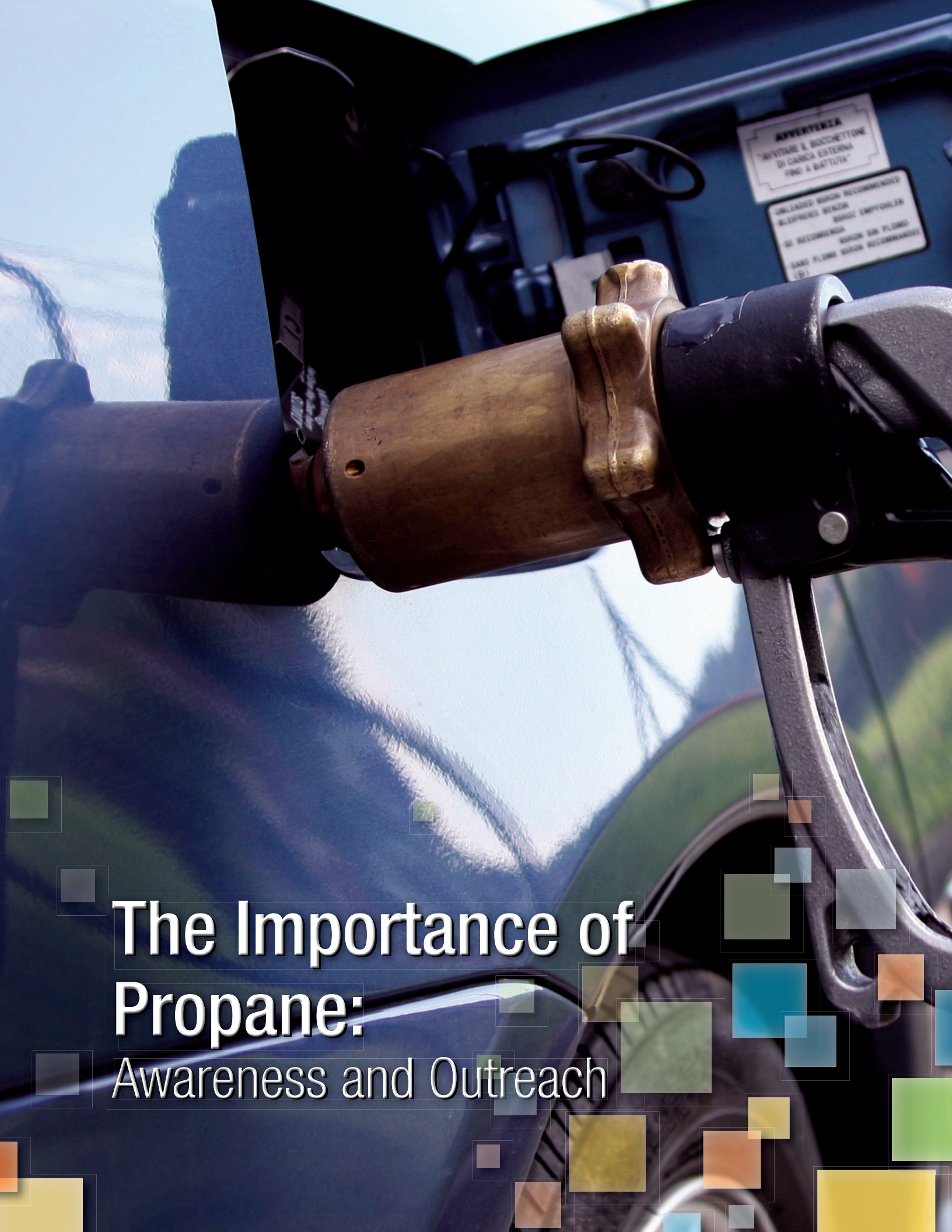

The Importance of Propane:

Awareness and Outreach

Notes

The Importance of Propane
Awareness and Outreach

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National Alternative Fuels Training Consortium
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The Importance of Propane

This material will discuss the importance of propane and propane vehicles. The advantages and reasons to consider adopting propane will be explored, as well as a discussion of the health, environmental, economic, and energy security benefits associated with alternative fuel technology. Finally, suggested actions to support and resources to learn more about alternative fuels, such as propane will be presented.

Objectives

- Discuss how propane may help improve public health
- Describe the benefits of propane to the environment
- Explain how propane may help stimulate the economy
- Describe what energy security is and how using propane can help attain it
- Explain the future of propane
- Explain the suggested actions to support propane

Why Consider Propane?

There are many reasons to consider the use of propane. One of the primary advantages (see **Figure 1**) to using propane vehicles is that it can produce fewer emissions than conventional gasoline vehicles. Propane vehicles burn cleanly and can run at higher compression ratios, resulting in high energy output, while producing lower emission levels than conventional vehicles. While the cost of a gallon of propane fuel varies, it generally costs less than a gallon of gasoline. At the time of this manual the national average price for propane was about 13% less than that of gasoline on a liquid gallon basis, but 26% more based on GGEs.

LPG COMPARED TO CONVENTIONAL GASOLINE	
Advantages	**Disadvantages**
• 90% of propane used in U.S. is produced domestically • Lower operating costs • Lower carbon monoxide, hydrocarbon, PM, and NO_X emissions when compared to gasoline • Higher octane rating	• Limited availability of vehicles (OEMs vs. conversions) • Limited locations with vehicle fueling capabilities • Price fluctuations

Figure 1: *LPG compared to conventional gasoline. Source: Fueleconomy.gov.*

Advantages of Propane

Nearly all U.S. propane is produced domestically. More than half of the U.S.-produced propane is a byproduct from natural gas purification (see **Figure 2**). This is an important advantage as nearly all natural gas is produced domestically. There is also a well-developed supply infrastructure for propane.

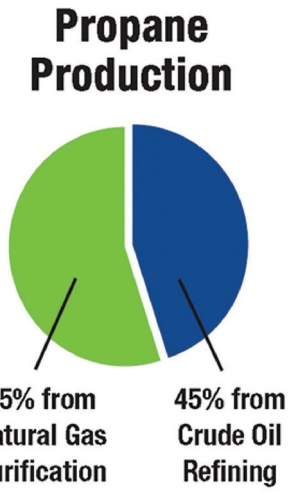

Figure 2: *Propane production. Source: EERE.*

Additional Points to Consider

The primary challenge of dedicated propane vehicles is their limited driving range when compared to conventional vehicles. This is a result of the relatively low energy content of propane fuel compared to gasoline based on liquid volume. Because the energy content of propane is less than that of gasoline by volume, more space for fuel is required to equal the range of the same vehicle operating on gasoline.

There is a limited worldwide supply of readily available oil and natural gas, and both are nonrenewable fuel sources. This may have an impact on the availability and price of propane in the future. For this reason the price of propane closely follows that of gasoline, diesel, and fuels used for home heating.

Propane Benefits

There are many benefits in expanding the use of propane as a transportation fuel — for the betterment of human health and the environment, economy, national energy security, and to help reduce the dependence on foreign oil.

Health Benefits

Propane is not soluble in engine oil and therefore produces lower hydrocarbon (HC) emissions from engine oil consumption. This also can extend oil life. When compared to conventional gasoline, LPG can produce up to 20% less carbon monoxide (CO), 40% less HC, and 30% less oxides of nitrogen (NO_X) emissions. It also produces lower particulate matter (PM), such as soot than conventional gasoline engines. These emissions have been linked to the formation of smog. Ground level ozone can create or irritate existing cases of asthma, emphysema, and bronchitis. Since propane produces fewer of these harmful emissions, the effects on individuals that are predisposed to these conditions are lessened.

Notes

Environmental Benefits

Propane is an approved, clean fuel listed in the 1990 Clean Air Act as well as the National Energy Policy Act of 1992. Propane is one of the simplest hydrocarbons in existence, and, as a result, is one of the cleanest burning of all fossil fuels. As discussed above, LPG use can produce lower emissions when compared to gasoline and diesel counterparts (see **Figure 3**). These emissions can lead to acid rain, which negatively affects various ecosystems.

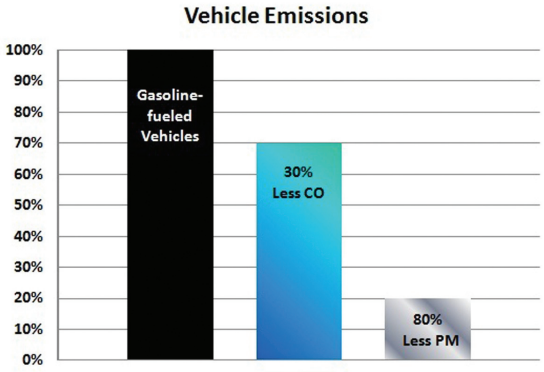

Figure 3: *Propane vehicle emissions. Source: AFDC.*

Transporting and storing of propane in sealed tanks reduces evaporative emissions and chances of spillage. Special fueling valves also control harmful evaporative emissions during the fueling process. Propane as a fuel is much cleaner to use than oil or gasoline and presents no threat to soil, surface water, or ground water. If propane were to be spilled outdoors, the fuel would rapidly biodegrade in soil, water, or air. Greenhouse gases (GHGs) are also thought to contribute to global warming. However, propane gas when released is not considered a greenhouse gas (GHG). LPG also produces less **carbon dioxide** (CO_2) when compared to conventional fuels.

Economic Benefits

Of all the alternative fuels, propane is the most accessible to the general public. Propane is practical and convenient for consumers and fleet operators. It can be obtained in almost every city and town in the country. When compared to conventional gasoline and diesel fuel, the GGE price of LPG is typically similar. Seasonal variations do occur due to supply and demand fluctuations in home heating use. Typically, propane prices increase slightly during winter months or heating season — which extends from October through March of each year. Even though the GGE price is not necessarily cheaper than conventional fuels, economic benefits occur over the life cycle of an LPG vehicle. The Battelle Memorial Institute found that propane is the most economic alternative fuel for fleets (on a per-mile basis) when operating, ownership, and infrastructure cost are considered.

Energy Security Benefits

The U.S. imports roughly half of its petroleum, two thirds of which is used to fuel vehicles in the form of gasoline and diesel. With much of the worldwide petroleum reserves located in politically volatile countries, the U.S. is vulnerable to supply disruptions. The increased use of alternative fuels can reduce national fuel consumption, which in turn decreases U.S. dependence on imported petroleum and increases energy security. As U.S. production of oil and natural gas increase, so will domestic production of propane.

About 90% of the propane consumed in the U.S. is produced in North America. Additionally, propane may be used in conjunction with gasoline to reduce overall gasoline consumption. The practice of reducing gasoline consumption by supplementing its use with propane will not reduce the use of fossil fuels, but it will allow for the use of more refining byproducts.

Propane – Today and Tomorrow

According to the Propane Education and Research Council (PERC), the U.S. consumes more than 15 billion gallons of propane annually for home, agricultural, industrial, and commercial uses. Of the 101.5 million U.S. households, 8.1 million depend on propane for one use or another. There were more than 270,000 on-road propane vehicles in the U.S. at the beginning of 2012. This number includes private businesses and municipal government agencies vehicles. Currently, propane vehicles are being used in fleet applications such as school buses, taxicabs, law enforcement vehicles, and medium-duty trucks and vans (see **Figure 4**).

Figure 4: *Ford E250 propane van. Source: AFDC.*

The Future of Propane

Due mostly in part to the existing propane infrastructure, the future of propane used as a transportation fuel is bright. U.S. produces nearly 90% of the propane it uses. More than half of this is a byproduct of domestically produced natural gas. Increased use of domestic resources such as this helps the United States' economy, and energy security by decreasing dependence on foreign oil.

Propane fuel injection systems have evolved dramatically over the past five years. These systems now inject liquid propane directly into the engine intake, which allows for better performance and fuel economy. As these technologies continue to be refined more vehicles may use propane. The future of propane vehicles also may be affected by new natural gas reserves that are being discovered within the U.S. Since LPG is a byproduct of natural gas production, it may become more readily available as natural gas production increases.

Did You Know?

Propane has grown to become a $49 billion industry in the United States.

Source: Propane Education & Research Council

Suggested Actions

In an effort to reduce America's dependence on foreign oil, and reduce emissions and greenhouse gases, the federal government, state governments and even regional and local governments have implemented incentives to encourage the purchase and use of propane. There is an established market of equipment such as propane-fueled forklifts (see **Figure 5**) that are available for consumer purchase. These vehicles often can be fueled by tank removal and filling at the same locations that refill RV and grill LPG tanks.

Figure 5: *Propane warehouse equipment. Source: NAFTC.*

LPG is the leader among alternative fuels used in the U.S. Even though station numbers and available vehicles are limited, continued interest should be invested in propane vehicles by consumers and fleet managers. A majority of U.S. propane is domestically produced and more than half is a by-product of natural gas production. Continued use and growth of propane as an alternative fuel can decrease fuel consumption from gasoline and diesel produced from imported oil.

Check with local businesses and state and city governments to inquire about incentives to convert niche fleets to utilize LPG. Encourage business owners, school board members, and government officials to attend a Petroleum Reduction Technologies workshop and learn more about the importance of LPG.

Finally, visit the AFDC website (http://www.afdc.energy.gov/afdc/fuels/propane_locations.html) to see where propane stations are located. Operation of or conversion to, propane vehicles, may be easier than expected.

Summary

With all of the advantages propane vehicles have to offer, an increasing number of these advanced technology vehicles will continue to be seen on the road. With a strong and growing infrastructure in place, propane is in a good position to be more widely used when compared to other alternative fuels that will require major changes in vehicle production and fuel distribution. LPG is a byproduct of petroleum, there is a limited amount of it available in the world and the purchase price tends to rise with that of all petroleum products. However, utilizing this by-product can decrease emissions produced from vehicles and ensure that all the crude and natural gas refining products are efficiently utilized.

Upon completing this material, can you

- Discuss how propane may help improve public health?
- Describe the benefits of propane to the environment?
- Explain how propane may help stimulate the economy?
- Describe what energy security is and how using propane can help attain it?
- Explain the future of propane?
- Explain the suggested actions to support propane?

Test Your Knowledge

1) What percentage of propane used in the U.S. is produced domestically?

2) **True or False:** Correctly calibrated LPG engines offer lower emissions of carbon monoxide.

3) **True or False:** Propane stations are hard to find since there are only 267 throughout the U.S.

4) Current U.S. LPG consumption is at __ billion gallons per year.

Answers: 1) 90%; 2) True; 3) False — there are over 2,600 stations across the U.S. 4) 15.

Conclusion

Of all the alternative fuels, propane is the most accessible to the general public. Propane is produced as a by-product of natural gas processing and crude oil refining. It accounts for about 2% of the energy used in the United States, with uses including home and water heating, cooking and powering farm and industrial equipment.

Propane is an easily accessible, widely-used alternative fuel. Propane vehicles perform similarly to conventional vehicles and provide economic and environmental benefits. Propane offers many advantages when compared to conventional gasoline. Some of the benefits of these vehicles include:

- Reduced vehicle emissions
- Improved energy security
- Comparable vehicle performance
- High energy density by mass
- Widespread fueling infrastructure – currently 2,563 LPG stations in the U.S.

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