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Status and Issues for Propane in the United States

Alternative Fuel and Advanced Vehicle Technology Market Trends

National Renewable Energy Laboratory

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Clean Cities
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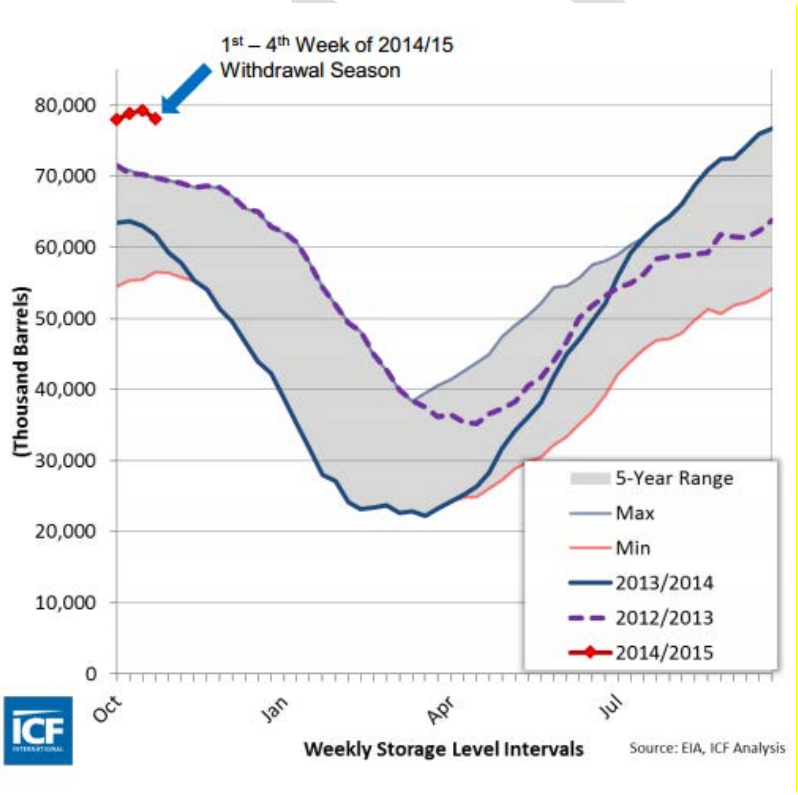
Propane vehicles continue to be a viable alternative to conventional light-, medium-, and heavy-duty vehicle technologies. These vehicles have a long and successful history in many applications and have economic, energy security, and environmental benefits. Technology advancements, increased vehicle and engine offerings, and an abundant domestic supply of propane—also referred to as propane autogas when used as an automotive fuel—have spurred growing fleet interest in the alternative fuel.

Current Market Status
Propane is a byproduct of natural gas processing and crude oil refining. As of 2012, only 1% of the U.S. propane supply was imported from outside North America.[1] Propane autogas is the same basic propane used for residential heating, cooking, and grilling. It is also used as a petrochemical feedstock and exported internationally. Propane is shipped from its point of production to bulk distribution terminals via pipeline, railroad, barge, truck, or tanker. Propane marketers then purchase propane at terminals and distribute the fuel to customers, including retail or private fueling stations.

Currently, the United States is the world's largest propane producer and a major stakeholder in the propane export industry. Propane supply is expected to continue to grow for the foreseeable future. The U.S. Energy Information Administration (EIA) estimates that propane will continue to be abundantly available, with average annual production between 2.25 and 3 million barrels per day through 2040.



[1] ICF International, "2013 Propane Market Outlook Update," http://www.icfi.com/insights/reports/2013/propane-market-outlook-2013 (accessed 1/13/2015)

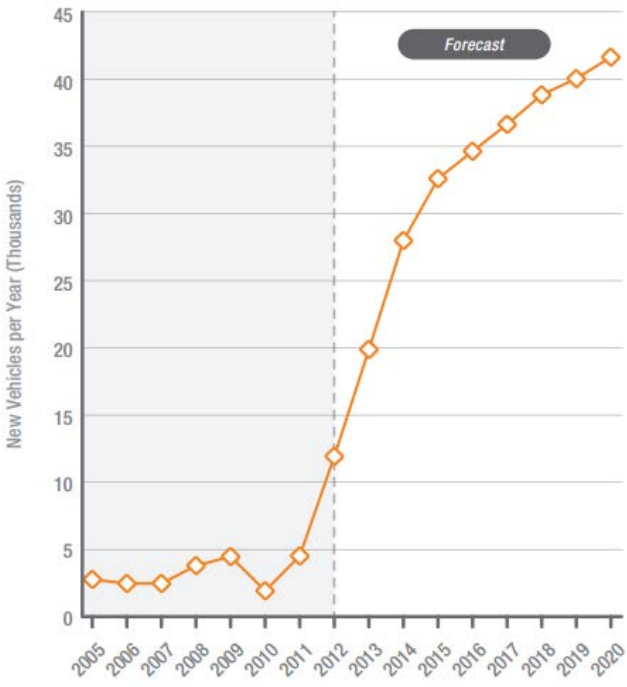
Figure 1. National inventory levels of propane production above the five-year historical range (as of October 30, 2014)[2]

In recent years, growth markets for propane have included on-road vehicles, agricultural (e.g., irrigation) engines, commercial mowers, and residential uses. Key on-road transportation markets include school and shuttle buses, taxis, delivery vehicles, law enforcement vehicles, and other centrally fueled fleets, discussed later in this report.

Vehicles

The EIA estimates that nearly 140,000 propane vehicles were operating in the United States in 2011,[3] representing about .04% of the nation's vehicles. As of 2011, the largest numbers of propane vehicles and propane fuel consumption were found in Texas, California, and the southeastern states of Georgia, Florida, and North Carolina.[4]

The number of propane vehicles in use has declined since its high of nearly 200,000 in 2003. Figure 2, however, illustrates industry sales projections which indicate that a variety of factors, such as price advantage, new engines, and fueling infrastructure, and increased acceptance by commercial vehicle fleet operators, may result in more than 220,000 propane vehicles on the road by 2020. Industry predicts these vehicles are expected to consume more than 400 million gallons of propane each year.[5]



[2] ICF International, "Propane Inventory Update and Winter 2014/2015 Supply Assessment," October 30, 2014, http://www.propanecouncil.org/uploadedFiles/Council/Site_Sections/Marketer_Resources/Teaser/ICF%20Winter%20Supply%20Assessment%20-%20October%2030%202014.pdf (accessed 1/13/2015)

[3] EIA, "Alternative Fuel Vehicle Data: Overview," http://www.eia.gov/renewable/afv/index.cfm (accessed 1/15/15)

[4] EIA, "Alternative Fuel Vehicle Data: User and Fuel Data," http://www.eia.gov/renewable/afv/users.cfm?fs=a&ufueltype=lpg#tabs_charts-5 (accessed 1/15/15)

[5] ICF International, "2013 Propane Market Outlook Update," http://www.icfi.com/insights/reports/2013/propane-market-outlook-2013 (accessed 1/13/2015)

Figure 2[6]

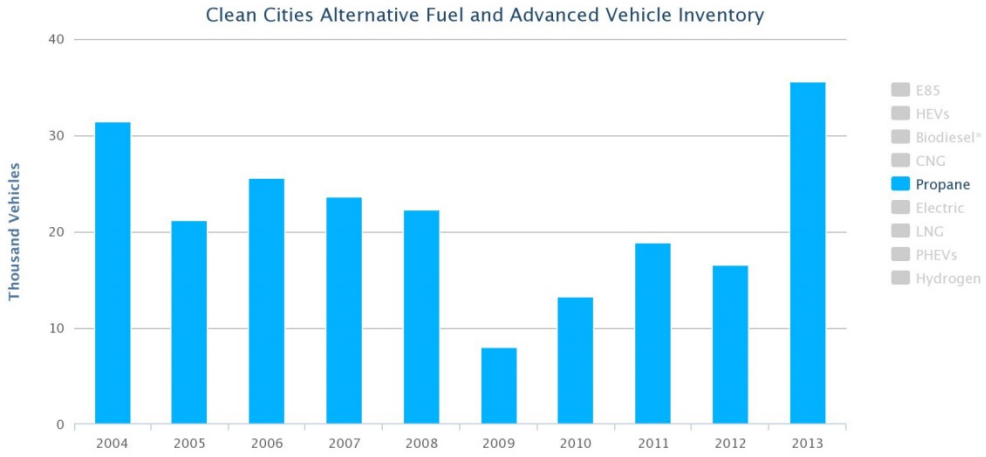


Figure 3. Clean Cities propane vehicle inventory reported by coalitions (2004–2013)[7]

Clean Cities project awards under the American Recovery and Reinvestment Act achieved significant results in deploying propane vehicles and infrastructure. Through the end of 2014 ARRA projects reported deployment of 3,623 propane vehicles and 263 fueling stations, all of the infrastructure is which are dedicated to vehicle fueling. At the end of 2014 the total number of propane stations in the AFDC database was 2,931, so more than 11% of the propane stations were established under Clean Cities Recovery Act projects. Recovery Act projects can be credited with significantly growing the percentage of propane fueling sites specifically for vehicle fueling.

Vehicle Technology

Propane vehicles, which have been widely used and refined for decades, operate much like gasoline vehicles with spark-ignited engines.[8] Light-, medium-, and heavy-duty propane vehicles are available in two configurations: 1) dedicated vehicles that run exclusively on propane and 2) bi-fuel vehicles that have two separate fueling systems, enabling the vehicles to switch between propane and gasoline.

Existing vehicles may be converted or new vehicles may be delivered through select dealerships either directly from the original equipment manufacturer (OEM) or with propane "prep" packages, which enable a qualified system retrofitter (QSR) or qualified vehicle modifier (QVM) to install the propane fuel delivery system before delivery to the customer. More than a dozen propane-compatible engines are currently certified for on-road use by the U.S. Environmental Protection Agency (EPA) or the California Air Resources Board. These engines provide a variety of options for fleets, including school and transit buses, shuttles, service vehicles, delivery vehicles, street sweepers, vocational trucks, and law enforcement vehicles.[9,10]

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[6] ICF International, "2013 Propane Market Outlook Update," http://www.icfi.com/insights/reports/2013/propane-market-outlook-2013 (accessed 1/13/2015)

[7] AFDC, "Clean Cities Alternative Fuel and Advanced Vehicle Inventory," http://www.afdc.energy.gov/data/10581/ (accessed 1/13/15)

[8] ICF International, "2013 Propane Market Outlook Update," http://www.icfi.com/insights/reports/2013/propane-market-outlook-2013 (accessed 1/13/2015)

[9] Propane Education and Research Center, "PERC-Certified Propane Autogas Vehicles List, October 2014," http://www.propane.com/uploadedFiles/Propane/On_Road_Fleets/Propane_Conversions/Octobe2014OTRManufacturerListingPublicView.pdf (accessed 1/13/15)

[10] AFDC, "Alternative Fuel and Advanced Vehicle Search," http://www.afdc.energy.gov/vehicles/search (accessed 1/13/15)
Note: Examples of on-road engines that can operate on propane include the Ford 2.0L V4, 2.5L V4, 3.7L V6, 4.6L, 5.4L V8, 6.2L V8, and 6.8L V10, GM 4.8L, 5.3L, 6.0L V8 and 8.0L V8, PI 8.0L, and PSI 8.8L

Light-duty propane vehicle engines for cars, trucks, SUVs, and vans range in size from 2.0 to 6.0 liters (L). These vehicles are commonly used by fleets for police cruisers, taxicabs, and pick-up trucks. As shown in Figure 4, the number of light-duty vehicle options has increased significantly in the last three years.

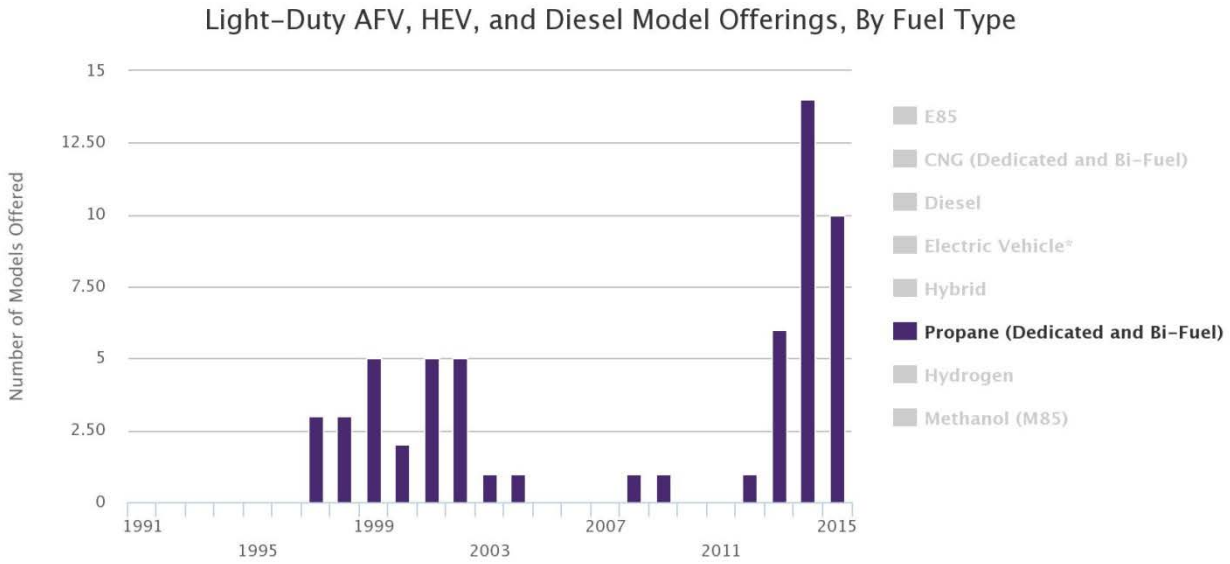

Figure 4. Light-duty propane model offerings (1991–2014)[11]

The options for medium-duty propane vehicles have expanded as well—such as with the Freightliner MT-45/55 and the Freightliner S2G—with engine sizes ranging from 6.0 to 8.8 L. These vehicles are available for a wide variety of applications, including government, university, and commercial fleets that use walk-in vans (e.g., package delivery and industrial laundry), tool and utility service trucks, box trucks, service vehicles, and shuttle buses. Propane buses are also a popular option for school districts, with a selection of Type A and Type C buses manufactured by OEMs, such as Blue Bird, Collins, Navistar, and Thomas Built.

The initial purchase price of a propane vehicle is several thousand dollars more than a comparable conventional fuel vehicle; however, propane vehicles can provide a quick return on investment. A light-duty conversion may cost as little as $6,000, while a new propane school bus may have an incremental cost of $15,000 or more. As compared to their compression-ignition (diesel) counterparts, spark-ignited engines are typically less expensive.[12]

Infrastructure

The availability of public infrastructure that is dedicated to vehicle fueling is commonly cited as a barrier to adoption. While propane fueling infrastructure is widely available today, some sites fuel vehicles as a secondary business to filling propane bottles or RVs, which can make fueling vehicles challenging because of many factors: hours of operation, cards accepted, price for vehicle fuel. More public infrastructure designed to fuel vehicles would have a significant market impact for the advancement of propane vehicles. According to the U.S. Department of Energy's Alternative Fuels Data Center (AFDC), and as shown in Figure 5, nearly 3,000 public and private propane fueling stations are in operation or are planned in the United States.[13] Less than 50% of those stations have a "primary" designation which indicates they offer fuel priced specifically

[11] AFDC, "Light-Duty Alternative Fuel Vehicle, Hybrid Electric Vehicle, and Diesel Model Offerings by Fuel Type," http://www.afdc.energy.gov/data/10303 (accessed 1/13/15)

[12] ICF International, "2013 Propane Market Outlook Update," http://www.icfi.com/insights/reports/2013/propane-market-outlook-2013 (accessed 1/13/2015)

[13] AFDC, "Alternative Fueling Station Locator," http://www.afdc.energy.gov/locator/stations/

for use in vehicles. With projections of 220,000 propane vehicles on the road by 2020, significant growth in infrastructure would be needed.

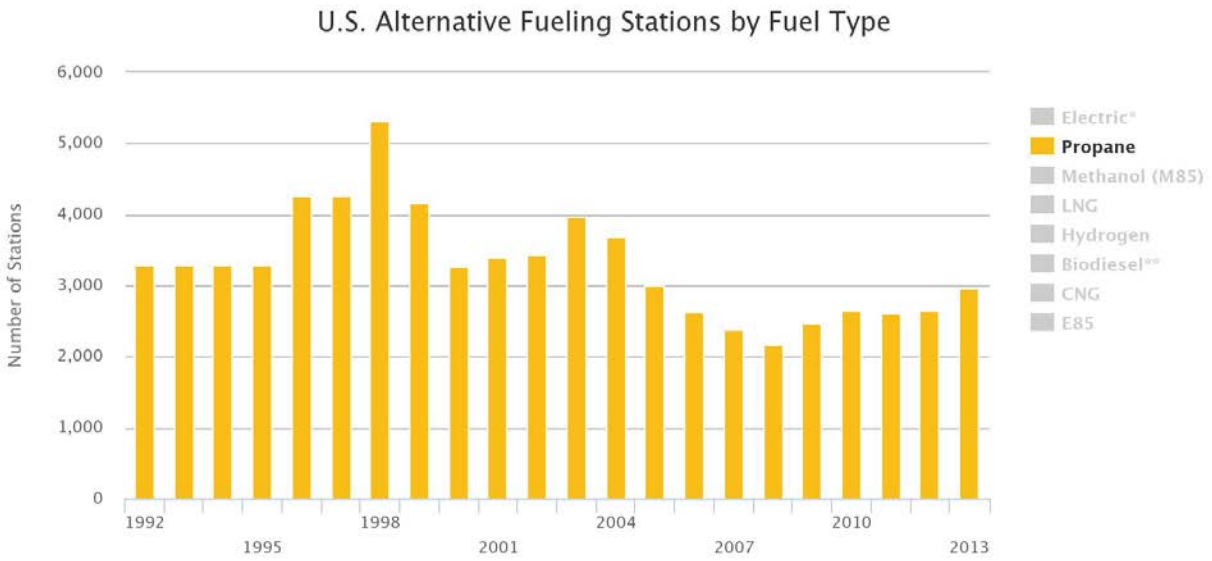

Figure 5. Number and type of alternative fuel stations in the United States (1992–2013)

Propane production, storage, and bulk distribution capabilities already exist across most of the United States, so establishing increased propane fueling infrastructure for vehicle fueling only requires the build-out of dispensing equipment. This equipment includes a storage tank on a concrete pad, pump, dispenser, and card reader (or more complex fuel management system) at a station site. Propane is brought to the site via a delivery truck and put into onsite storage, traditionally above ground. Stations may be skid-mounted or fully installed. Typical skid-mounted units, which are compact and easier to install, have a 1,000- or 2,000-gallon storage tank. Larger fueling sites may have more permanent storage tanks with a storage capacity of 9,000 to 12,000 gallons. NFPA code allows for propane fueling equipment to be next to gasoline and diesel equipment.

In addition, many existing retail sites sell propane in small volumes, for example to fill grill canisters and mowers. To increase demand, those sites can upgrade or expand their dispensing equipment to a retail-style metering dispenser with a card reader to accommodate and encourage vehicle refueling. In such cases, the appropriate pump and motor combination should be installed to enable adequate vehicle filling. The cost of such an upgrade varies widely depending on the facility location, infrastructure, operations, but are generally relatively low cost..

Although propane fueling dispensers are similar to gasoline dispensers, propane is delivered to the vehicle under pressure to maintain its liquid state. The following section on trends provides more information about new nozzle technologies.

Fleets can work with their local propane distributor to explore opportunities to lease the tank, pump, and dispensing equipment as part of a fuel supply contract. In such cases, the station owner is responsible for certain costs. The remaining equipment and installation costs are amortized in the fuel supply contract.

Propane infrastructure, which is relatively inexpensive and easy to install, must comply with local codes and standards. The cost of establishing propane infrastructure typically ranges from $45,000 to $300,000, depending on the size and number of storage tanks and dispensers, the infrastructure

already in place (e.g., electricity lines), and payment system requirements.[14] Infrastructure costs have been documented in *Costs Associated with Propane Vehicle Fueling Infrastructure.*[15]

Vehicle and Fuel Incentives and Policies

Many states offer financial incentives that reduce the cost and shorten the payback period of propane vehicles. These incentives include tax credits and exemptions, grants, loans, vouchers, and rebates. Some states also offer non-financial incentives, including emissions testing, high occupancy vehicle lanes, and vehicle weight limit exemptions, to increase the appeal of propane vehicles. Similarly, some state laws and regulations encourage the use of propane in transportation (e.g., fleet acquisition requirements) and ensure safe operation of the vehicles (e.g., vehicle decals). Figure 6 illustrates trends in propane incentives and laws in all 50 states and the District of Columbia. The peaks and valleys generally coincide with industry and legislative trends such as increased funding for incentive programs resulting from the American Recovery and Reinvestment Act of 2009, widespread interest in rebate programs for fleet vehicles beginning in 2013, and the focus on alternative fuel tax rates and equivalencies in recent years.

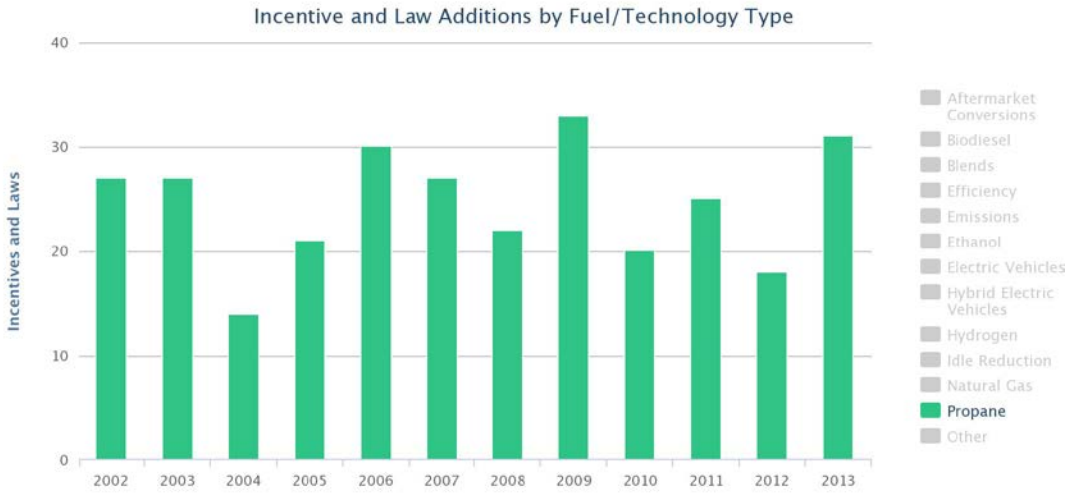

Figure 6. Propane-related incentives and laws by fuel and technology type (2002–2013)[16]

Figure 7 illustrates the current number of incentives and laws related to the use of propane vehicle fuel in each state. Historically, states that have higher adoption rate of propane vehicles have a combination of other factors that support adoption like available infrastructure, a strong state propane association, or incentives in the form of rebates or tax credits.

[14] AFDC, "Alternative Fueling Station Locator," http://www.afdc.energy.gov/locator/stations/

[15] AFDC, "Costs Associated with Propane Vehicle Fueling Infrastructure, August 2014," http://www.afdc.energy.gov/uploads/publication/propane_costs.pdf

[16] AFDC, "Incentive and Law Additions by Fuel/Technology Type," http://www.afdc.energy.gov/data/10360 (accessed 1/13/15)

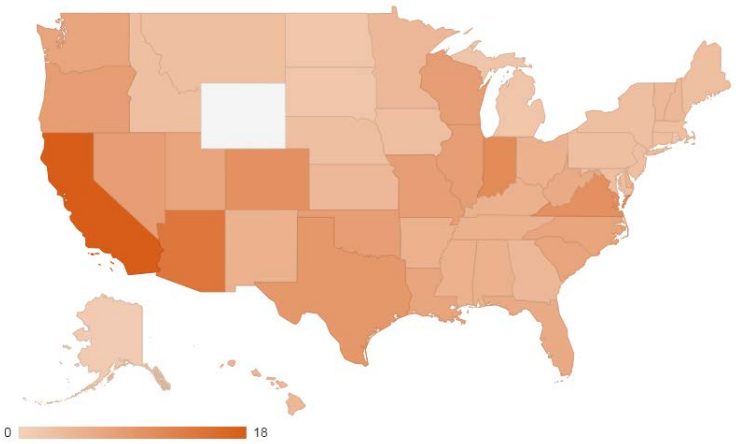

Figure 7. Propane-related incentives and laws by state (2002–2013)[17]

Federal tax incentives, such as the $0.50 per gallon alternative fuel excise tax credit and fueling infrastructure credit, expired at the end of 2014 after being retroactively extended for one year.

Propane vehicles are required to meet national safety and fire protection guidelines just like conventional vehicles. The U.S. Department of Transportation, NFPA and other organizations provide safety guidelines for propane vehicles.[18]

Barriers

Propane for transportation has a lot of advantages. Vehicles and engines operate reliably, there is plentiful supply of domestic propane, and there is a significant established infrastructure for distributing propane. However, this established infrastructure also presents some challenges. Converting an infrastructure and industry not originally designed for transportation means that existing dispensing equipment, vehicle conversion practices, pricing strategies, hours and locations of operation, and payment methods are not consistent. This presents challenges to creating a positive driver/user experience.

Trends

Dispensing Technologies

An emerging technology change for propane infrastructure is the style of nozzle used at fueling stations. Propane fueling technology in the United States utilizes the 1.75-inch Acme connector. The challenges associated with this connector including training to use fuel a vehicle and required safety equipment, may be overcome by the European-style nozzle and connector, which fastens to the vehicle via a snap or quick connect. This nozzle style mitigates the need for safety equipment, reduces the amount of fugitive emissions by approximately 75%, and minimizes training requirements. Because the nozzle is not standard in the United States, vehicles would need to be retrofitted with a European-style connector, also known as a fill valve. Adapters are also available for vehicles or dispensing equipment, ensuring the nozzle would have wide usability. The European-style nozzle costs about $1,200 and the connectors and adapters range from $50 to $60 each.[19] Underwriters Laboratory is currently evaluating applications by two European-style nozzle manufacturers, and industry experts estimate that it will take two to five years to change out all of the

[17] AFDC, "Propane Incentives and Laws by State," http://www.afdc.energy.gov/data/10377 (accessed 1/13/15)

[18] National Fire Protection Association, "NFPA 58," nfpa.org/codes-and-standards

[19] LP Gas, "Propane Industry Leaders Make a Case for European-Style Refueling Technology," October 7, 2014, http://www.lpgasmagazine.com/propane-industry-leaders-make-a-case-for-european-style-refueling-technology/ (accessed 1/13/2015)

nozzles. In the interim, propane vehicle manufacturers and aftermarket conversion companies are offering the European adapter as an option.

Self-Contained Infrastructure Technology

While propane fueling for vehicles is available at more than 3,000 locations across the country, fleets may opt to acquire their own infrastructure due to station proximity, economic advantages, or fleet operating needs. An emerging option for fleets, either on a temporary or permanent basis, is the full-service, skid-mounted fuel storage and dispensing unit. These units have the advantage of being a low or no cost option, and include a storage tank and dispensing equipment, and can be built and sold or leased by the provider to a fleet. Costs for skid mounted units are highly variable depending on the fuel supply needs and contract. These units are currently available and the number of providers is expected to grow as the propane vehicle market expands.

Vehicle Technology[20]

In vapor injection technology, liquid propane is controlled by a regulator or vaporizer, which converts the liquid to a vapor. A variety of liquid injection systems are also available, such as the CleanFUEL USA liquid propane injection system, the Roush CleanTech liquid propane fuel system, and the Bi-Phase LPEFI liquid propane fuel system.[21,22] Technology advances in liquid injection systems have led to expanded choices for propane vehicles in recent years. Existing and new industry partnerships, including those associated with the Propane Education and Research Council, will likely lead to further expanded vehicle and commercial mower offerings.

Propane Supply Contracts

Some fleets are reluctant to purchase propane vehicles due to concerns about price instability and fuel availability. Unseasonably cold weather during the winter of 2013/2014 resulted in propane shortages because of the fuel's increased use for heating, which also drove up prices. Though these issues may be a concern during limited periods of the year, propane is generally abundant year-round and fleets can stabilize their fuel prices through long-term contracts. It's important for fleets to consult with local fuel providers and establish a fuel contract that secures fuel at a fixed cost, regardless of seasonal commodity price or supply fluctuations.

Impacts and Benefits

Petroleum Reduction Impacts[23]

Fueling vehicles with propane is one way to diversify U.S. transportation fuels. The vast majority of propane consumed in the United States is produced here and distributed via an established infrastructure. Using propane vehicles instead of conventional vehicles reduces U.S. petroleum imports and increases the nation's energy security.

Emissions Reduction Impacts[24]

Increasingly stringent emissions regulations have led to the development of improved emissions control systems in conventional light-, medium-, and heavy-duty vehicles. These systems effectively control the levels of air pollutants emitted from the vehicle as a result of fuel combustion. Consequently, emissions of criteria pollutants from propane vehicles are comparable to those of gasoline and diesel vehicles with modern

[20] Adapted from ICF International's "2013 Propane Market Outlook Update," http://www.icfi.com/insights/reports/2013/propane-market-outlook-2013 (accessed 1/13/2015)

[21] This and any other mention of specific manufacturers is only a representation of the market, not a comprehensive list

[22] ICF International, "2013 Propane Market Outlook Update," http://www.icfi.com/insights/reports/2013/propane-market-outlook-2013 (accessed 1/13/2015)

[23] AFDC, "Propane," http://www.afdc.energy.gov/fuels/propane.html

[24] AFDC, "Propane," http://www.afdc.energy.gov/fuels/propane.html

emissions controls. However, the costs of emissions control systems for conventional vehicles, particularly for diesel engines, are much higher than for propane vehicles.

Propane engines have lower greenhouse gas (GHG) emissions than gasoline or diesel engines. Argonne National Laboratory's GREET model estimates life-cycle petroleum use and GHG emissions for multiple fuels.[25] As noted by the AFDC, when the GREET model is used to evaluate propane-fueled vehicles, it found that propane use reduces GHG emissions by nearly 10% compared to gasoline. Additionally, when propane is derived as a by-product of natural gas production, it reduces petroleum use by 98% to 99%. The Propane Education and Research Council compared GHG emissions from forklifts, buses, and light-duty trucks operating on various fuels in *Propane Reduces Greenhouse Gas Emissions: A Comparative Analysis*.[26]

Opportunities

Several key niche markets show promise as the next stepping stone in advancing propane in the marketplace. Listed below, these niche markets were identified based on several factors, including the potential market for propane in the segment, the potential impact that propane will have on the fleet's bottom line, the match between fleet needs and propane technology, and the potential for the niche market to lead to expansion to other fleets and market segments.

- **School Buses:** The propane industry is well positioned to penetrate the school bus market in a major way. School bus fleets operate more than 675,000[27] buses in the United States. OEMs offer a range of propane-powered school buses, and state and local incentives are often available. Approximately 2% of the school districts in the nation currently use propane buses.

School Bus Market Potential Impact

Number of Vehicles	675,000 buses
Diesel Fuel Economy	6.2 mpdge
LPG Fuel Economy	5.6 mpdge
Total Potential CO_2 Reduction (million tons/y)	1.2M GHG short tons

- **Paratransit and Shuttle Operations:** There are more than 6,500 para-transit systems across the United States operating more than 65,000 vehicles.[28] These vehicles could operate on propane. Vehicles in this niche qualify for Federal Transit Administration funding, which covers up to 85% of the incremental cost for alternative fuel vehicles. Because of the low cost of establishing infrastructure, propane is a good alternative for para-transit fleets transitioning to alternative fuels. Vehicles in the para-transit industry are similar to a variety of shuttle operations, so experience and lessons learned could be shared across the niches.

Paratransit Market Potential Impact

Number of Vehicles	65,000
Diesel Fuel Economy	8.5 mpdge
LPG Fuel Economy	7.7 mpdge
Total Potential CO_2 Reduction (million tons/y)	0.9M GHG short tons

[25] Life-cycle analysis is a technique used to assess the environmental impacts of all stages of a product's life, including raw material extraction, processing, manufacturing, distribution, use, and disposal or recycling. When comparing fuels, a life-cycle analysis may focus on particular portions of a fuel's life cycle, such as extraction-to-use or well-to-wheels, to determine the merits or problems associated with each fuel.

[26] Propane Education Research Council, "Propane Reduces Greenhouse Gas Emissions: A Comparative Analysis," http://www.propanecouncil.org/uploadedFiles/REP_15964%20Propane%20Reduces%20GHG%20Emissions%202009.pdf

[27] Federal Highway Administration – Highway Statistics 2012, Table MV-10, http://www.fhwa.dot.gov/policyinformation/statistics/2012/pdf/mv10.pdf

[28] American Public Transportation Association, "Public Transportation Fact Book," http://www.apta.com/resources/statistics/Documents/FactBook/APTA_2011_Fact_Book.pdf

- **Government Fleets:** According to 2013 vehicles in operation data from R.L. Polk & Company, more than 2.4 million government fleet vehicles are registered in the United States. Many government fleets are encouraged or even mandated to use alternative fuels. Propane presents a good opportunity for these fleets because of the relatively low price of entry (incremental vehicle costs and infrastructure costs) and the wide range of available engines. These fleets tend to use the types of vehicles capable of operating on propane, including sedans, trucks, vans/shuttles, and commercial mowers. Government fleets are often centrally fueled, so even if propane infrastructure is not available nearby, they can take advantage of low-cost, skid-mounted infrastructure while they establish their own fueling station. Additionally state incentives or programs may be available to offset some costs.

- **Delivery:** While recent United Parcel Service announcements put the spotlight on propane's potential in the delivery segment, other organizations, such as Schwan's, have successfully used propane in this niche market for years. Box trucks and step-vans typically used in the delivery niche are also used in a number of other niches. Increasing the use of propane in the delivery niche is a significant stepping stone to other niche markets.

Strategies for Advancing the Use of Propane Autogas
Coordination with Existing Clean Cities Activities

Communication Products
- **AFDC and Clean Cities Websites**: www.afdc.energy.gov; www.cleancities.energy.gov; A variety of tools and information are provided on these sites.
- ***MotorWeek* Series***:* www.youtube.com/cleancitiestv For more than 15 years, Clean Cities has had a long-standing relationship with *MotorWeek* which produces a series of Clean Cities success stories and feature-length segments for public television.
- **Success Stories/Toolkits**: Several niche markets, such as school buses and delivery vehicles, have experienced great early successes. Providing updated success stories would help others in these niche markets understand how propane could work in their fleets. Clean Cities is building toolkits for niche markets which may include case studies, FAQs, and slide decks specific to the niche.

Partnerships
- **National Clean Fleets Partnership:** www.eere.energy.gov/cleancities/national_partnership.html; Through the National Clean Fleets Partnership, Clean Cities works with large private fleets to cut petroleum use. The initiative provides fleets with resources, expertise, and support to incorporate alternative fuels and fuel-saving measures into their operations. Of the nearly 30 national partner fleets many operate propane vehicles.

Technical Assistance
- **Clean Cities University (CCU)**: CCU is an online learning tool for Clean Cities coordinators. Propane-related technical training could be added to Clean Cities University to help coordinators increase understanding about propane vehicles and infrastructure, with a focus on fuel supply contracts, liquid propane injection, dispenser technology, infrastructure operation, facility modifications.
- **Tiger Teams:** www1.eere.energy.gov/cleancities/technical_assistance.html Clean Cities has offers local coalitions and stakeholders troubleshooting for specific vehicle or infrastructure complexities related to alternative fuels and advanced technologies.

Tools

- **AFDC Station Locator**: www.afdc.energy.gov/locator/stations/ A comprehensive set of data for propane, and all alternative refueling locations across the US. Data can also be searched to identify primary vs. secondary fueling locations for propane.
- **Alternative Fuel Price Report**: A quarterly report designed to keep Clean Cities coalitions and others up to date on the prices of alternative and conventional fuels. Collaboration with the propane industry has led to prices at primary and secondary stations being called out separately in the report. Regular communication with industry about price report results is important.

New Clean Cities Activities

- **Expanding impact in key niche markets:** Working successfully with industry groups has long been a hallmark of the Clean Cities program. Establishing productive working relationships with these groups in key niche markets listed above presents a significant opportunity to expand alternative fuel use in those niches. Seeking to first understand their membership and the challenges they face would help Clean Cities design niche specific webinars, presentations or articles.
- **State Propane Gas Associations:** Strengthening the relationship between coalitions and each state's propane gas association offers significant opportunity to advance the use of propane in vehicles. Clean Cities and the National Propane Gas Association have initiated conversations about how to best connect coalitions with their state group and inform coalitions about the role those groups play. Defining how to make those connections and formalizing an approach will ensure members understand the local market for propane vehicles and infrastructure.
- **Engagement on Codes and Standards:** Other fuel types, such as ethanol and natural gas, have benefitted from Clean Cities' involvement in codes and standards. Propane autogas would benefit as well—updating codes to ensure they are comprehensive, working with code officials and end-users to ensure adherence to codes, and publishing a codes and standards reference guide for end users.
- **Technical Workshops and Education**: Confusion about propane and related vehicle technologies is common among end-users, particularly regarding the latest technology, safety, applicable codes, conversions, and infrastructure design and operation. Technology-related workshops or trainings would help fleets understand the benefits and challenges of using propane and how to best implement propane vehicle technology.
- **Conversion Tutorials:** Because of the wide array of conversion options and propane vehicle providers, making good choices about vehicle conversions can be daunting. Conversion tutorials would help fleets understand what a good conversion looks like, how to inspect conversions, and how to understand the types of service a retrofitter provides.
- **Infrastructure Best Practices:** A guide outlining infrastructure best practices would help fleets understand the various infrastructure options and issues, design infrastructure to meet their needs, and maintain infrastructure for their fleets. This would include outlining key equipment needs for adding propane fueling to an existing bottle-fill propane outlet.
- **Fleet Engagement and Workshops:** Collect feedback from fleets and end-users on their experiences and identify next steps in making the user experience seamless.
- **Industry Stakeholder Engagement:** Meet with industry stakeholders to identify key barriers and issues. Continually refine Clean Cities' activities to best address the most pressing industry issues.