

BUILD WITH PROPANE GUIDE

RESIDENTIAL EDITION



YOUR HANDBOOK FOR PROPANE SYSTEMS,
NEW TECHNOLOGY, AND PRODUCTS.



Welcome to the Build with Propane Guide.

This book is designed to help you learn more about propane's versatility in providing gas energy for both traditional appliances and innovative new applications. Additionally, this guide provides a wide range of information on the energy efficiency and environmental benefits that propane can deliver to high-performance homes.

Domestic, Clean, Versatile, and Safe

Propane is a nontoxic gas produced from natural gas processing and crude oil refining. Propane is made in America. In fact, the United States is a net exporter of propane, which means we make more than enough to meet demand. In the wake of the shale revolution, domestic propane supply has greatly increased, and this fuel can now do even more to advance America's energy security and protect the environment. There has never been a better time to build homes using propane as the primary energy source.

Propane is already being used in over 48 million U.S. households for residential uses, including grilling, and by millions of other Americans for transportation, commercial, industrial, and agricultural applications.

Propane shares the same operating characteristics as natural gas, so when natural gas is not available for your project, or the cost of bringing natural gas to each home site exceeds your project budget, don't make your clients give up on their desire to have the efficiency, comfort, and high performance of gas in their new or remodeled home. Offer propane as the best gas energy choice.



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Choosing Propane Made Easy by the Propane Education & Research Council

The Propane Education & Research Council (PERC) oversees propane's growing footprint as a safe, clean, and domestically produced energy source by funding research on propane applications in residential and commercial construction, as well as in lawn and landscaping, agriculture, and transportation. PERC is fully invested in driving the development and commercialization of innovative propane applications for new-home construction, remodeling, and efficiency upgrades, especially when high performance at an affordable price is an important consideration.

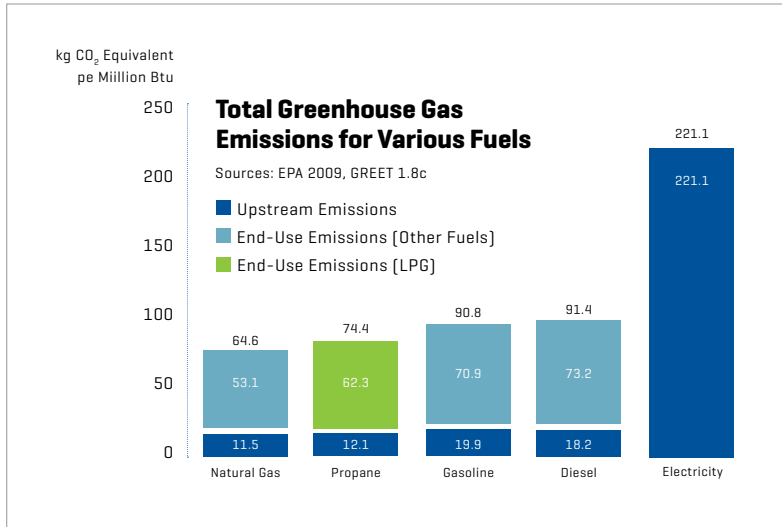
Over the last several years PERC has invested millions of dollars in research, case studies, online training courses, training videos, and guides such as this one. PERC's investments include training on the integrated approach of the Propane Energy Pod, an energy-efficient and environmentally friendly path to high-performance new-home construction. Find out more about the Propane Energy Pod on pages 4-5 of this guide.

Exceptional Energy

The Basics

There are a few fundamentals you and your clients should know about propane:

It's clean energy. Propane emits less than half the greenhouse gas emissions of electricity to produce the same amount of energy. That is because more than 40 percent of the electricity



in the United States is produced by coal-fired power plants. In colder climates like the Midwest, high-efficiency propane-fueled furnaces produce half as many carbon dioxide emissions as electric air source heat pumps. This large difference in environmental performance is driven by heat pumps' use of electric resistance backup heating during times of cold ambient temperatures. In fact, by using propane, you can earn points under green building programs, such as the National Green Building Standard and LEED for Homes.

It reduces energy costs. Propane appliances are typically far more efficient than their electric counterparts. For example, an Energy Star-qualified propane tankless water heater can save your customers up to 50 percent on their energy bills, when compared with the costs of operating a

standard electric storage tank water heater. High-efficiency propane furnaces offer best-in-class efficiency, with ratings of 98 annual fuel utilization efficiency (AFUE) now available. That 98 percent efficiency means big savings on heating bills for homeowners, coupled with an affordable installation cost for the heating system.

It supports modern lifestyles. Propane provides your customers with the ability to choose first-rate amenities regardless of where they live. Propane space heating is available in both forced-air and radiant systems that can be zoned for individual room comfort. And propane standby generators can provide peace of mind and security for customers in locations that experience rolling blackouts or storm-related power outages.

It's builder-friendly. With propane, you're not at the mercy of a public utility. And with the option of aboveground or underground storage tanks, propane professionals can install properly sized propane storage and connect home appliances and other applications on your build schedule. Propane also provides jobsite flexibility by providing gas energy for portable generators and temporary construction heaters.



Propane storage can be buried underground with only an inconspicuous service dome showing.

Exceptionally Safe

Why are more of your new-home construction and remodeling peers telling customers about the benefits of propane? Consider the following:

It’s domestically produced. Propane is an efficient, clean byproduct of oil refining and natural gas processing. Propane is made in America, and a transportation network that includes pipelines, rail, and trucks distributes it to retailer distribution points across the country. Propane’s reach goes well beyond that of natural gas, whose limited infrastructure is costly to expand. That makes propane a readily available and affordable domestic gas energy source that contributes to U.S. jobs, economic growth, and energy security.

It’s designed for safety. Typically used in gas form, propane is stored and transported as a liquid under pressure. Propane is nontoxic and odorless, so processors add a chemical odorant [ethyl mercaptan] to help users detect leaks by way of an easy-to-identify rotten-egg smell.

It’s installed by pros with top-quality training. The propane industry’s voluntary Certified Employee Training Program [CETP] helps ensure that propane installation and service personnel are well qualified to handle even the most challenging tasks. In addition, propane is a well-regulated industry that follows the codes and standards set by the National Fire Protection Association [NFPA], the Department of Transportation, the Department of Energy, and various state and local regulatory bodies. For more information, go to propanesafety.com.



Typical Propane Consumption (Gallons/Year)

Climate Region	High Efficiency Space Heating	High Efficiency Water Heating	Cooking	Clothes Dryer	High Efficiency Direct-Vent Fireplace	TOTAL
Warm	22-79	112-119	~17	~28	~16	194-258
Moderate	71-433	124-153	~17	~28	24-31	268-662
Cold	620-790	490-620	~17	~28	39-55	991-1844

Source: Newport Partners 2011 Energy and Environmental Analysis of Propane Energy Pod Homes. Complete study available at buildwithpropane.com > Resources > Propane Energy Pod. Findings are based on climate averages across 16 locations developed through building energy simulations. Assumptions include a 2,400-square-foot home built to the 2009 IECC, and the use of high-efficiency propane heating and water heating equipment, moderate efficiency propane direct-vent fireplace, and standard efficiency propane cooktop, oven, and clothes dryer. Warm and moderate climates were assumed to use hybrid air source heat pumps with propane furnace backups for space heating.

CO₂ Emissions National Average

[metric tons per billion Btu consumed]

Propane	Heating Oil	Electricity
63	73	175

Source: Developed from U.S. EPA data, taken as average of 50 states and Washington, D.C.

Key Benefits of the Propane Energy Pod

Efficient Systems. The Propane Energy Pod uses highly efficient appliances for a home's most important energy applications. This means you can meet your most demanding customers' expectations with style and ease.

Green Profile. When chosen in place of heating oil or electricity, the Propane Energy Pod lowers a home's overall carbon footprint — often the equivalent of a car's emissions for a year.

Energy Rebates. The Propane Energy Pod enables your customers to reap maximum benefits from any available federal, state, and local energy rebate and tax credit programs. See page 23 for additional rebate information.

On-Site Energy. When your customers tap into the Propane Energy Pod, they can claim a unique feature: Clean, reliable energy that's on site. That's especially true if a customer chooses to add a propane standby generator, which protects them from unexpected power outages.

The Propane Energy Pod

Builders looking for the latest innovative energy solutions should get to know the Propane Energy Pod. It's a model for new-home construction that merges five applications of propane — space heating, water heating, cooking, fireplaces, and clothes drying — into an integrated, whole-home energy package. Building professionals are successfully applying this five-in-one energy solution to maximize efficiency, performance, comfort, and carbon-emission reductions.

You'd like to increase sales, and your customers want to reduce their energy bills. The Propane Energy Pod's integrated, research-based solution can help you deliver homes that outperform both new construction and existing housing in energy and CO2 emissions. The Propane Energy Pod can help homes qualify for above-code green building programs and federal, state, or local incentives for energy improvements made to the home.



Keeping Score: The Propane Energy Pod vs. Standard Homes

Newport Partners LLC, an independent third-party research firm, conducted careful modeling analysis of home energy consumption and CO₂ emissions for two homes — one built following the Propane Energy Pod model and one built with standard appliances and systems. The results suggest that Propane Energy Pod homes achieve measurable energy and carbon savings over those built with conventional systems. Below is a sample result comparing the Propane Energy Pod home with a standard home whose applications run on electricity.

The Propane Energy Pod vs. Standard Homes

3,600-Square-Foot Home [cold climate]	Propane Energy Pod Home	Standard Home	Annual Savings
Energy Costs	\$4,873	\$5,409	\$536
Annual Emissions [metric tons CO ₂]	21.7	32.4	10.6
Home Energy Rating System [HERS] Index	64	83	The lower the score, the more efficient the home

Source: Newport Partners LLC

Bringing the Pod Outdoors with Pod PLUS

The five applications of the Propane Energy Pod are core to a home's energy savings and low-emissions profile, but outdoor living features such as generators, outdoor cooking, outdoor lighting, and flame effects can add just as much to a home's overall comfort and resale value as its indoor spaces. At buildwithpropane.com/energypod, you can check out real-world success stories from projects that also include outdoor Pod PLUS applications: propane-fueled features that give your clients luxurious and energy-efficient outdoor spaces.

[Use the Home Energy Rating System to Gain Referrals](#)

If you're looking for a new way to showcase the value of your home construction over competitors', consider applying the Home Energy Rating System (HERS) to your projects. Developed by the Residential Energy Services Network (RESNET), the HERS Index compares a Propane Energy Pod home with a built-to-code reference home. The index also allows comparisons of different home designs and specifications. The HERS measure works across various climate zones and is used by builders to differentiate their high-performance homes from standard new and existing homes.

To try the Interactive Propane Energy Pod Tool, which shows HERS Index ratings of different homes, go to buildwithpropane.com/energypod.

Creating Exceptional Comfort and Efficiency

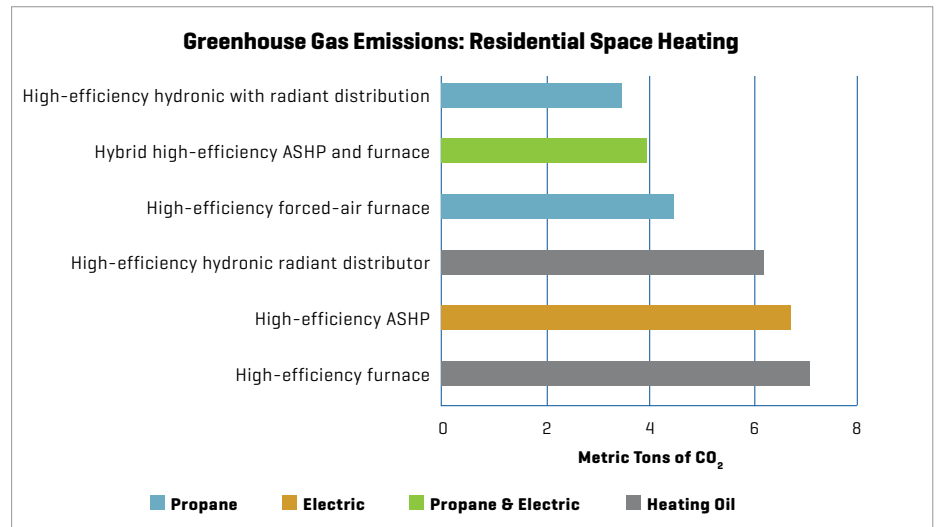


If you're a builder or remodeler, here's a hot marketing message: Propane is one of the most versatile space heating fuels on the market. Propane home heating systems can be configured as central or zone, forced air or radiant. Plus, propane zone heaters, fireplaces, and hearth stoves provide your customers with plenty of choices for their supplemental space heating needs. Best of all, propane systems can help slash energy costs and greenhouse gas emissions in new construction, remodeling, and efficiency upgrade applications.

Buildwithpropane.com offers a handy tool to help you start the conversation with homeowners. The Heating Energy Cost and Carbon Calculator is an interactive module, tailored to a home's individual region and climate, that estimates the annual cost to run a home's space heating or domestic hot water system. It also measures the amount of carbon dioxide emissions associated with the system's operation. Give it a try at buildwithpropane.com/energycalc.

FREE ONLINE TRAINING: A Comparative Analysis of Residential Heating Systems

Learn how to compare heating systems in terms of initial costs, operating costs, carbon emissions, and payback periods. Go to buildwithpropane.com/training or download the complete Comparative Heating Systems Study at buildwithpropane.com > Research > Comparative Heating Study.



Source: Newport Partners 2013 Heating Study. Lower numbers represent lower greenhouse gas emissions. Findings are national averages based on computer energy simulations of a typical new home across 20 locations in warm, moderate, and cold climate zones.

Consider the following propane applications for your next project. Many are manufactured as Energy Star-qualified models:

Propane furnaces. High-efficiency propane furnaces offer best-in-class efficiency, measured by AFUE. Propane furnaces with AFUE ratings of up to 98 are readily available. Direct-vented units take all air needed for combustion directly from outdoors, which improves efficiency and the home's indoor air quality. Many high-efficiency propane furnaces are two-stage or variable-speed units, so the furnace heats the home steadily and comfortably. The heated air leaves the furnace at temperatures typically near 120 degrees Fahrenheit, significantly warmer than the delivery temperatures offered by air source or ground source electric heat pumps. Propane furnaces can qualify for the Energy Star Most Efficient label, whereas heating oil furnaces are not eligible. Propane furnaces also have a smaller carbon footprint than most other heating systems.

Check for available tax credits and other incentives on propane furnaces at buildwithpropane.com/rebates and your local propane retailer.

Radiant floor hydronic heating. Here, a propane water heater or boiler heats the water that a pump forces through an underfloor tubing system. Since water retains heat far longer than air, the hot water boiler fires less frequently than a forced-air furnace, making radiant systems a highly efficient and comfortable heating choice. And, you can zone in-floor radiant heat with great precision.

Fireplaces and hearth stoves. High-efficiency propane fireplaces are an effective complement to home heating. They can be more than 90 percent efficient and enable homeowners to heat larger areas within a home. On the other hand, traditional wood-burning open fireplaces are only about 15 percent efficient. Propane fireplaces offer flexible design and cost-effective installation. The ability to direct-vent propane fireplaces means there's no need for a chimney. They're comfortable, they're convenient, and they produce ambience and comfort within seconds without the ash, soot, or smoke of a wood-burning fireplace, which contribute to major environmental problems in some parts of the country.

Ductless zone heaters. Propane zone heaters, which can be used in homes, garages, and outbuildings, come freestanding or wall-mounted. You can fit these units with thermostats and blowers, and some provide reliable spot heat even during electrical outages.

Key Benefits of Propane Fireplaces

Flexible design and cost-effective installation.

The ability to direct-vent propane fireplaces (no chimney needed) and their low clearance requirements offer design flexibility and installation simplicity. That means propane fireplaces can safely fit in any room of the house, including bedrooms, bathrooms, and basements.

Energy efficient and budget-friendly. Vented propane fireplaces can have efficiency levels of more than 90 percent. On the other hand, traditional wood-burning open fireplaces are only about 15 percent efficient.

An effective complement to home heating.

Propane fireplaces are available in high efficiencies (more than 90 percent) that let them heat larger areas within a home, making them an effective complement to a home's main heating system. There's little or no drop-off in efficiency when using the fireplace. Plus, there's the added benefit of fireplace ambience.

Easy on the environment. Unlike a wood-burning fireplace, a propane fireplace doesn't produce ash, soot, or smoke, which contribute to major environmental problems in some parts of the country.

Comfortable and convenient. Homeowners with a propane fireplace are just seconds away from the ambience, comfort, and heating it offers.

Water Heating That Won't Drain the Pocketbook



While most new-construction or remodeling customers are likely concerned about rising utility costs, they may not realize how much water heating affects the total bill.

According to the Department of Energy, 15 to 25 percent of home energy costs result from heating water for showers, dishwashers, and other domestic hot water uses.

How can you help customers combat rising hot water costs? In a word: propane. When it comes to water heaters, electricity simply can't compete with propane. In fact, more than 400 models of propane tankless and storage tank water heaters qualify for the federal Energy Star program, while most electric models do not qualify. Looking for more selling points? Propane water heaters cost up to 50 percent less to operate and can save up to one ton of greenhouse gas emissions each year when compared with standard electric storage tank water heaters. That's a win for customer pocketbooks and for the environment.

Fixture Flow Rate

To select the right tankless unit, add up the gallons per minute estimated for the customer's household during peak demand. Then, match it to the EnergyGuide label on the water heater.

Fixture	Gallons Per Minute
Bathroom sink	1.0
Bathtub	4.0-5.0
Shower	2.5
Multiple showerheads	2.5-12.0
Kitchen sink	1.5
Dishwasher	1.5
Washing machine	2.0

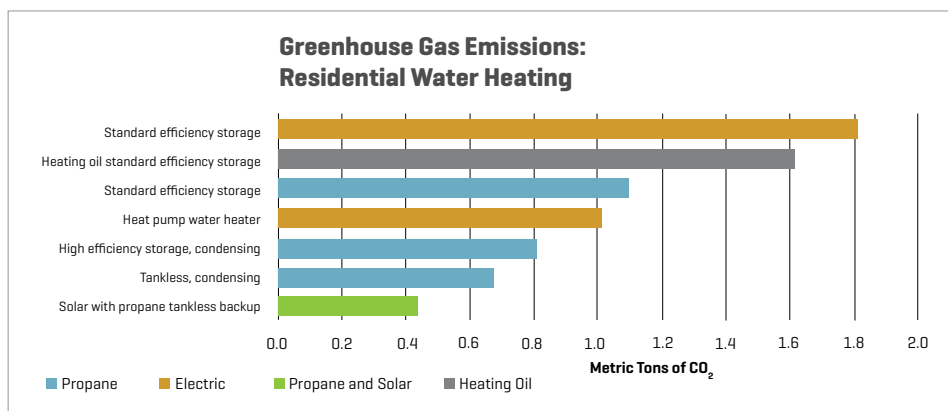
Source: tanklesswaterheatersdirect.com. Flow rate for customers' appliances and fixtures will vary due to differences in local water pressure, as well as appliance and fixture performance.

Propane-fueled tankless water heaters can typically achieve a hot water flow rate that is three times that of the flow rate from electric storage or heat pump water heaters. Because propane-fueled tankless water heaters provide this hot water flow continuously, the hot water supply will not run out.

Most models of high-efficiency propane water heaters now incorporate direct-vent or power-vent designs. These capabilities allow through-the-sidewall venting options, eliminating the need for a vertical flue chase going up through the home.

Check for available tax credits and other incentives on propane water heaters at buildwithpropane.com/rebates and your local propane retailer.

Propane meets or exceeds the performance of other energy choices for residential water heating.



Source: *Comparing Residential Water Heaters for Energy Use, Economics, and Emissions* by Newport Partners, LLC. Complete study available at buildwithpropane.com/waterheating. Lower numbers represent lower greenhouse gas emissions. Findings are national averages based on computer energy simulations of a typical new home across 10 locations in warm, moderate, and cold climate zones.

Key Benefits of Propane Tankless Water Heaters

Reduced energy costs. Propane tankless water heaters can reduce energy costs by up to 50 percent and eliminate standby energy loss from the tank as well as unnecessary expenses to heat water when it is not being used.

Lower annual cost of ownership. According to a 2011 Newport Partners study of residential water heating systems, propane tankless water heaters offer the lowest annual cost of ownership in four out of five U.S. climate zones and far better performance than other models tested.

No cold showers. Propane tankless water heaters provide an endless supply of hot water, averaging about 222 gallons per hour, compared with an average first-hour delivery rating of just 62 gallons per hour for electric storage tank models. For homeowners, this gap in hot water delivery rates is often the difference between a hot or a cold shower. Tankless units are available with hot water recirculation systems to quickly provide hot water at the tap or showerhead.

Compact size. A propane tankless water heater can save up to 16 square feet of floor space over a standard storage tank model. Because a propane tankless water heater is so compact, it fits easily near hot water distribution points, which saves both water and energy and can be a significant factor in qualifying for above-code green building programs.

Long service life. Propane-fueled tankless water heaters have a life expectancy of about 20 years, much longer than any conventional storage water heater.



FREE ONLINE TRAINING:
Propane Tankless Water Heating

Ready to learn more about how tankless water heaters can help your customers maximize environmental retrofits and efficiency-driven upgrades? Go to buildwithpropane.com/training.

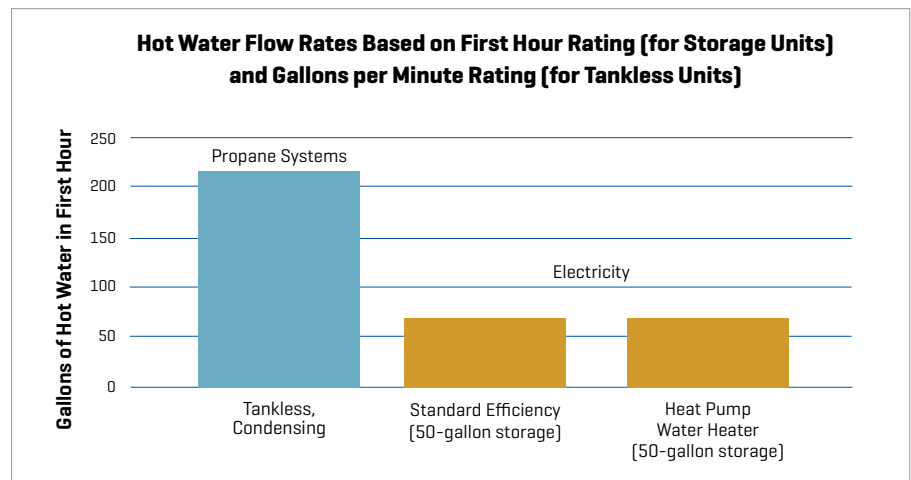
Installation and Maintenance Tips

Propane tankless water heaters are less labor-intensive to install than tank-style units, and they use the same plumbing as natural gas water heaters. Most high-efficiency propane models use a fan to power-vent exhaust vertically or horizontally [the fan may require a minimal electrical connection]. Some tankless models can be installed outside of the home.

For both tankless and storage tank propane water heaters, proper installation depends on a number of factors, such as unit placement, climate, and local building codes. To ensure the unit vents and operates properly, be sure to follow the manufacturer’s instruction guide.

Both propane tankless and storage tank water heaters require minimal maintenance beyond annual checkups. Since a tankless unit doesn’t maintain a stored water supply, it’s less subject to corrosion. In fact, tankless water heaters can last twice as long as electric storage tank units. Just as important: Most of the parts are recyclable, so when the tankless water heater reaches the end of its operating life, little of it needs to go to a landfill.

Propane meets or exceeds the performance of other energy choices for residential water heating.



Source: *Comparing Residential Water Heaters for Energy Use, Economics, and Emissions*, Newport Partners LLC, September 2011.

Exceptional Cooking and Clothing Care

While propane boasts advantages for space and water heating, this exceptional energy draws customers seeking energy solutions for kitchen and laundry appliances as well. Consider the benefits:

Cooktops and ovens. In a survey of 100 professional chefs specializing in international cuisines, 96 percent said they preferred cooking with gas heat over electric. Discriminating customers prefer gas cooking, too. Propane cooktop burners allow for greater heat control and instant flame turnoff capabilities, while propane ovens help retain more moisture in food than electric units. Adding further appeal, propane cooktops, ranges, and ovens are available in sophisticated styles, including commercial-grade stainless steel.

Clothes dryers. Propane clothes dryers offer homeowners an efficient, convenient, and quick laundry solution. Compared with electric dryers, a propane clothes dryer will dry clothes faster and more efficiently. Propane dryers also offer the latest innovations, such as steam cycles to de-wrinkle and freshen garments, drum lights for a better view into the unit, and LCD control screens for ease of use. With propane, laundry day goes by a lot faster.

Propane clothes dryers have a smaller carbon footprint than electric dryers and can save more than 20 percent in energy costs compared with electric models. In new construction, going with propane means avoiding the cost of installing a 220V circuit for an electric dryer, too. The lower-cost 110V circuit for a propane dryer can also supply the clothes washer with power.

In a replacement or upgrade situation, propane clothes dryers can easily replace electric dryers to improve performance and efficiency. Both electric and propane clothes dryers use a single vent to exhaust to the outdoors, which simplifies electric-to-propane replacements.

When building or remodeling homes, consider piping both the kitchen and laundry areas to accommodate gas appliances. Why? Even if the initial customer chooses electric products, the future option of gas cooking and clothes drying appliances may help the property's resale value.



Product Directory

The Propane Products and Appliances Directory is your one-stop shop for information on a wide range of propane products, from cooking and clothes drying to vehicles and tanks. Check it out at **buildwithpropane.com**.

Add Value by Upgrading Outdoor Spaces



FREE ONLINE TRAINING: Outdoor Living

Ready to learn more about how you can use propane's exceptional energy to fuel the best in outdoor living for your customers? For full course details, go to buildwithpropane.com/training. Enroll today to learn more about the economic, environmental, and efficiency benefits of building and remodeling with propane while fulfilling your professional training requirements.

Whether you're an architect, a builder, or a remodeler, it's smart business to consider how propane can help you create competitive advantage. Thanks to an array of new appliances, propane can fuel a wide range of outdoor living amenities that can meet the needs of your most discerning customers.

To see all the ways propane can enable a high-performance home both indoors and outdoors, tour our interactive Virtual Home at buildwithpropane.com.

Grills. It's a fact: About 60 percent of home grillers prefer propane for outdoor cooking, largely because of its instant-heat precise temperature control. Another selling point: Propane grills release far less carbon monoxide, particulates, and soot.

Outdoor kitchens. For customers who want only the best in an outdoor kitchen, propane delivers. A premium built-in cooking area — complete with large grilling surface, cooktop, oven, and rotisserie — can easily be set up to operate on a propane cylinder or on a home's main supply tank.

Outdoor fireplaces, firepits, and heaters. Chilly weather is no match for a portable propane patio heater or outdoor fireplace. From small tabletop heaters that can help warm up an intimate outdoor dining area to floor-standing models that can deliver a circle of radiant heat up to 20 feet in diameter, propane's clean, versatile energy can raise the outdoor air temperature by between 10 and 30 degrees Fahrenheit. And propane outdoor fireplaces are clean, producing no smoke, soot, or ashes.

In-floor heating. This option is a perfect alternative for customers who don't want a fireplace but want to enjoy a more usable patio space during the colder months.

Pool and spa heaters. Propane is an excellent choice to help your customers enjoy a warm pool and spa experience, regardless of the weather. High-efficiency propane pool heaters can reduce customer energy bills, since they warm pools faster than electric units while better maintaining heat in cold conditions.

Lighting. Today's propane lighting manufacturers create a wide range of styles and options, including a selection of tabletop lamps, many of which can operate on a small, disposable propane cylinder. Tiki torch and pedestal-style propane lamps can create a great visual statement in outdoor entertaining spaces. These lamps eliminate the smell and residue that oil-burning torches can create, and many can burn for 10 hours or more on portable propane, or they can be supplied by the main propane storage tank. Propane lights can also accent landscaping and maintain home security — without the risk of going dark during power outages.

Mosquito control. Nothing can ruin an evening on the patio quite like mosquitoes. Propane-fueled mosquito traps can keep the party going. With a radius of up to an acre, these traps use propane to attract mosquitoes. Flameless technology makes these products a must-have for well-used outdoor living areas.

New plug-in gas outlets for indoor and outdoor use make connecting propane appliances as safe and easy as plugging in an electrical appliance. For more information, visit the Propane Products and Appliances Directory at buildwithpropane.com.

Five Benefits of Propane for Outdoor Living

Flexible. From outdoor kitchens to fireplaces to consistently warm pools, propane helps you meet the full range of customer needs.

Reliable. Homeowners can use propane to heat their grills faster than with charcoal and their swimming pools faster than with electricity. And, outdoor propane lighting stays on when electric-powered lighting goes dark.

Simple. With minimal or no connections to electricity required, propane makes it easy and cost effective for you to enhance a homeowner's outdoor living spaces.

Safe. Propane is nontoxic, colorless, and virtually odorless. As with natural gas, an identifying odor is added to propane so it can be readily detected.

Clean. Grilling with propane emits 99 percent less carbon monoxide per unit of energy than grilling with charcoal.

On Tap: Quiet and Reliable Power



One of the strongest selling points for residential generators, besides unpredictable weather, is the growing number of non-emergency electrical blackouts in the U.S. Should your customers need to worry about opening their refrigerator door in a power outage? Show them how propane standby generators can help maintain their quality of life.

A propane standby generator is ideal for customers who live in storm-prone areas or for those who just want the reassurance of never worrying about power loss. When coupled with an automatic transfer switch, home standby generators can deliver up to 150 kW of power within seconds after an outage takes place. To increase safety and convenience, many whole-home generators also feature remote monitoring systems that can alert customers to any potential operating problems. Emerging technology in generators also includes combined heat and power systems (CHP) for residential and commercial use. [See page 17.]

For customers who want an “off-the-grid” lifestyle — without sacrificing modern conveniences — propane generators are the perfect solution. An increasing number of manufacturers now build propane generators warranted for off-grid use when used as part of a renewable energy system. This may include, for example, residential systems where solar photovoltaic panels or wind generators supply electricity. When stored battery voltage cannot meet demand, the propane generator kicks in to recharge the batteries to ensure uninterrupted power

Installation

Propane standby and off-grid generator systems are housed outside, usually adjacent to a garage, shed, or other non-living space. These units typically draw propane from the home’s main propane storage tank.

Five Benefits of Propane Generators

Quiet. Many standby generator units produce less than 60 decibels of noise — as quiet as a normal conversation.

Quick. When equipped with an automatic transfer switch, a propane standby generator can produce supplemental electricity, often in as little as 10 seconds after primary power failure.

Safe. The American Red Cross recommends permanent standby generators over portable units as a safer means to provide backup power.

Dependable. A 7kW standby generator drawing fuel from a 250-gallon propane tank can provide enough electricity to power a home for up to five days. Unlike diesel or gasoline, propane won’t deteriorate while stored in the tank.

Reassuring. With a propane standby generator, your customers can be assured that basic lifestyle needs — such as heating, cooling, cooking, food storage, and hot and cold water supply — will continue under virtually any circumstances.

Exceptional Ideas for Exceptional Energy



Since its formation in 1998, PERC has awarded more than \$81.3 million for research and development of groundbreaking propane technologies through dozens of partnerships with top companies, universities, and national laboratories. The overriding goal of this support is to help manufacturers develop, test, and bring to market a steady stream of propane-fueled innovations. Some of the most recent residential accomplishments include the following:

Combined Heat and Power Systems [CHP]

Advanced research in cogeneration technologies has resulted in new CHP systems that improve on-demand performance and conserve energy. Marathon Engine Systems, Yanmar, and others have developed propane-fueled CHP units in which an engine drives a standby generator to deliver on-demand electrical power. At the same time, waste heat from the liquid-cooled engine is circulated through an exchanger and used for supplemental home heating. A key side benefit for both units: The CHP technology virtually eliminates power loss from transmission and distribution of electricity generated by a central utility.

Check for available financial incentives for the purchase and use of select CHP units in the Propane Heat and Power Incentive Program at buildwithpropane.com/rebates.

Generators That Integrate with Renewable-Energy Systems

In another area of PERC research partnerships, many manufacturers are testing new propane generator systems that can be integrated with other alternative-energy sources. For example, PERC awarded Generac a significant research grant to develop and test its EcoGen technology, a low-cost, long-life propane generator that provides supplemental power to homes that rely on renewable energy sources. The EcoGen technology was successfully commercialized, and the generators are now available.

Check for available financial incentives for the purchase and use of select off-grid generators in the Propane Heat and Power Incentive Program at buildwithpropane.com/rebates.



FREE ONLINE TRAINING: Propane-Enhanced Renewable Energy Systems

Ready to learn more about how the latest propane innovations can dovetail with customer demands for alternative or renewable energy? Go to buildwithpropane.com/training.

Four Steps to a Custom Fit



When it comes to job-site planning for propane, building professionals can follow four simple steps to ensure the right propane storage tank sizing and location and the proper regulator placement

1. Determine Tank Type and Size

There are two main types of propane storage tanks. Tanks with a Department of Transportation certification are generally used aboveground and have a maximum capacity of 125 gallons. Commonly used horizontal tanks certified by the American Society of Mechanical Engineers (ASME) are sized up to 1,000 gallons [water capacity] and, under normal conditions, can be filled with propane up to 80 percent of the rated water capacity. ASME tanks are available for underground or aboveground installation.

Overview of Tank Type and Size Guidelines

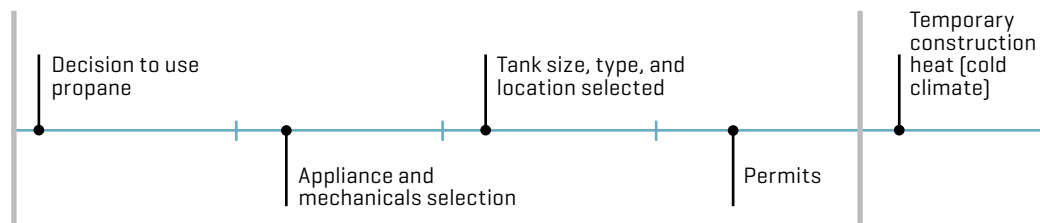
Project Size	Tank Type	Capacity	Dimensions
Single appliance	DOT or ASME Horizontal DOT or ASME Vertical	125 gallons 125 gallons	24" diameter, 5'6" length 30" diameter, 4'5" height
Small home or warmer climate with limited gas applications	ASME Horizontal ASME Horizontal	250 gallons 320 gallons	32" diameter, 7'3" length 30" diameter, 9'6" length
Standard four-bedroom home	ASME Horizontal	500 gallons	38" diameter, 9'10" length
Large home with multiple gas applications	ASME Horizontal	1,000 gallons	41" diameter, 15'11" length

Source: American Society of Mechanical Engineers (ASME) and Department of Transportation (DOT).

In addition to the guidelines noted above, other factors influencing tank size include total square footage of the home, total Btu load of installed propane appliances, and the climate zone. See the "Typical Propane Consumption" chart on page 3 for more details.

TIMELINE

While the timing on projects is rarely exactly the same, here's where propane would typically fit into your overall build schedule.



BEGINNING

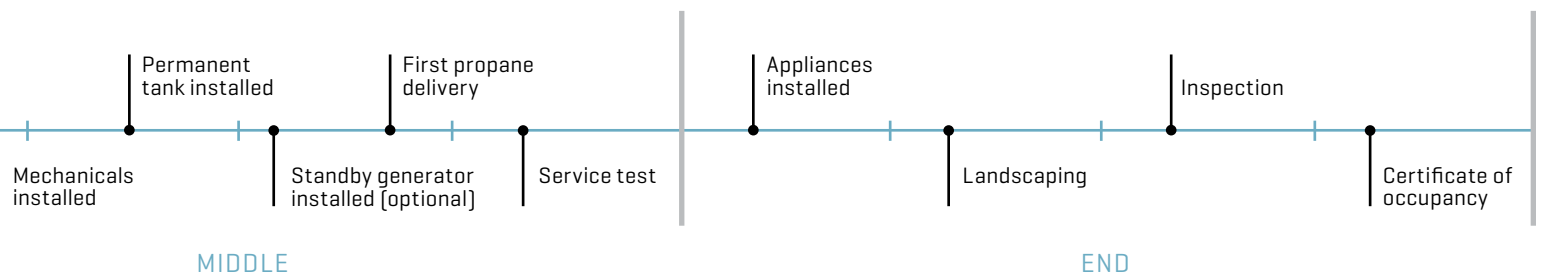
2. Place the Aboveground Tank or Cylinder Properly

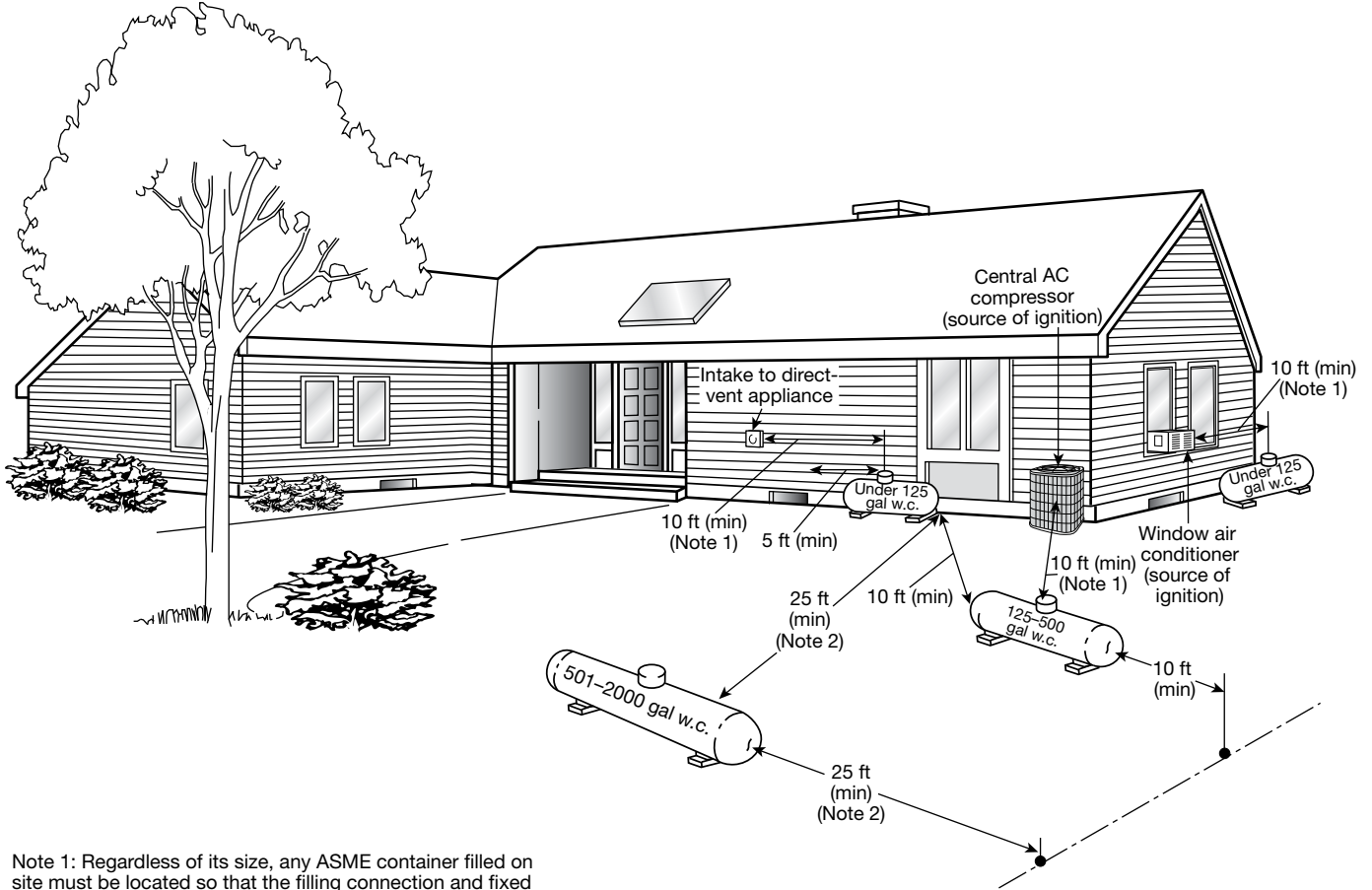
When selecting an aboveground location for a propane tank, the first priority is to choose an accessible, safety-approved site. Key considerations in that decision-making process include:

Building and safety codes. These regulations vary by state and local municipality. In addition to observing local codes, most states require that propane retailers follow the National Fire Protection Association (NFPA) 58: Liquefied Petroleum Gas Code [available at nfpa.org]. In most cases, propane tanks must have at least 10 feet of clearance from the home, other structures, and property lines.

Ease of access. When siting the tank, it's important to choose a location with easy access for filling and maintenance. For example, in colder climates, consider how delivery trucks will reach the tank during heavy snow conditions. Your propane supplier will give you tank location options.

Customer input. In addition to safety and accessibility, aesthetics play an important role in project success. Be sure to review all tank location options with your customer, taking into account their feedback for landscaping and overall site design.





Note 1: Regardless of its size, any ASME container filled on site must be located so that the filling connection and fixed maximum liquid level gauge are at least 10 ft from any external source of ignition (e.g., open flame, window AC, compressor), intake to direct-vented gas appliance, or intake to a mechanical ventilation system.

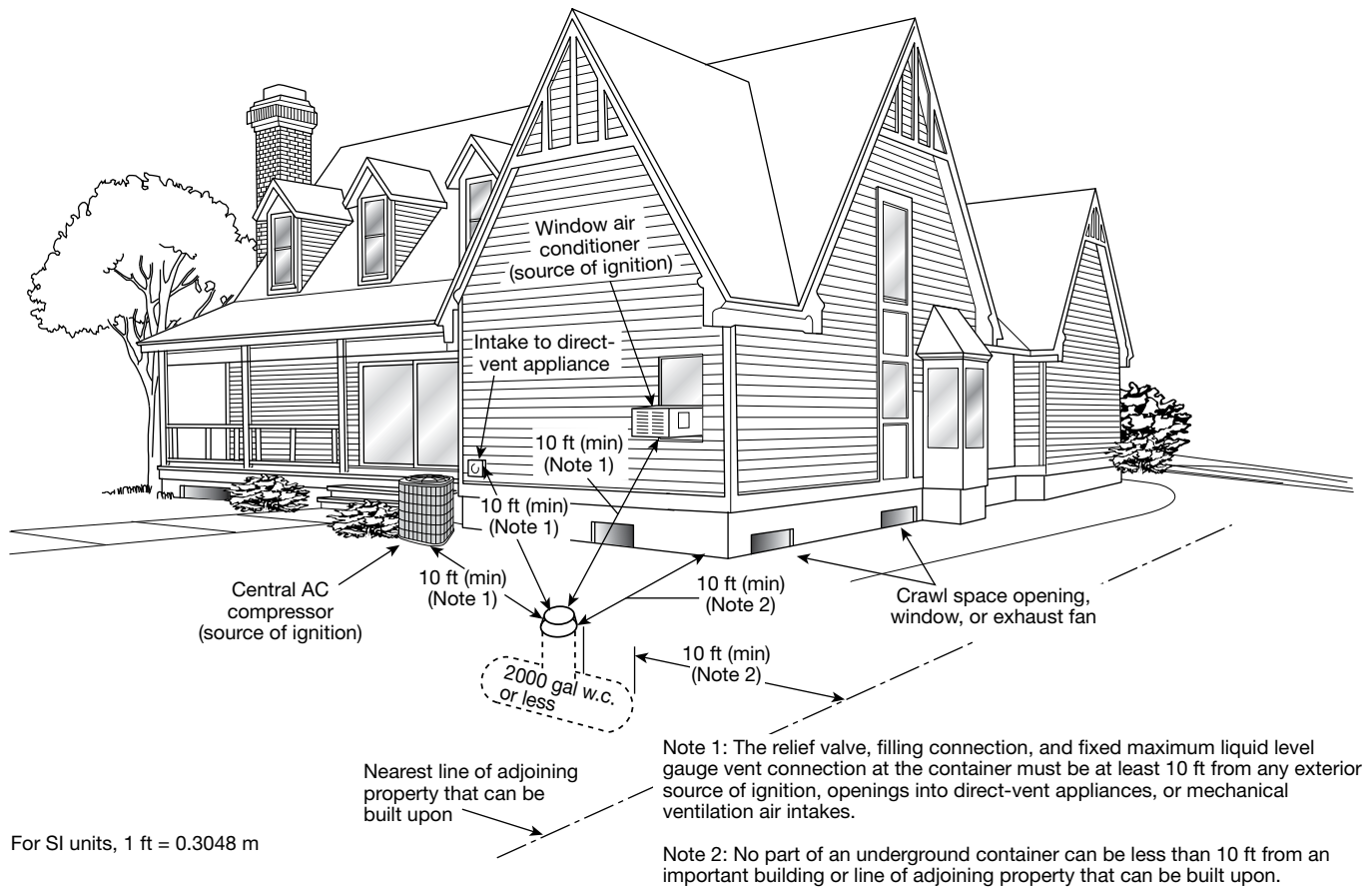
Note 2: This distance can be reduced to no less than 10 ft for a single container of 1200 gal (4.5 m³) water capacity or less, provided such container is at least 25 ft from any other LP-Gas container of more than 125 gal (0.5 m³) water capacity.



3. Choose Underground Tank Site Carefully and Follow the Permitting Process

With a nearly invisible profile, underground propane storage tanks have become an increasingly popular choice for new-construction customers, as well as homeowners seeking to upgrade their existing energy systems. For builders considering large-scale exurban or other “off-the-main” housing projects, an underground community tank system is an efficient, aesthetically pleasing way to deliver propane’s exceptional energy to customers.

As with aboveground tanks, installation permits and regulations for underground tanks will vary by location. In many cases where septic systems or other excavation projects are part of the overall site plan, it’s possible to coordinate excavation for underground propane storage tanks at the same time. When finalizing a location, choose a site that can easily accommodate propane delivery under all weather conditions.



4. Place the Propane Regulators Properly

Like storage tanks, propane regulators come with pipe-size and installation distance requirements. For example, regulators cannot be placed closer than three feet horizontally from any building opening [such as a window well] lower than the regulator. Additionally, a regulator installed on the gas piping inlet to the home cannot be placed closer than five feet from any potential ignition source, such as a compressor for central air conditioning. For complete compliance details, contact your nearest propane retailer.



Left page and this page: Reproduced with permission from NFPA 58-2011, Liquefied Petroleum Gas Code, Copyright © 2010, National Fire Protection Association. This reprinted material is not the complete and official position of the NFPA on the referenced subject, which is represented only by the standard in its entirety.

Earn Points Toward Green Certification



Propane can earn you more than 100 points toward the National Association of Home Builders (NAHB) National Green Building Standard and other above-code green building programs. These standards incorporate environmental considerations into every phase of the homebuilding process — from lot design and preparation to final construction and homeowner education. In fact, building with propane can get your new construction projects nearly halfway to qualifying for NAHB’s Bronze-level green building standard. Since propane performs well by a wide range of “clean and green” measurements, it’s also a smart choice for remodelers who want to help customers maximize efficiency upgrades or environmental retrofit projects.

Propane and the National Green Building Standard™

Learn more about the National Green Building Standard at nahbgreen.org.

Category	Maximum Points from Propane	NGBS Level of Certification			
		Bronze	Silver	Gold	Emerald
Lot Design, Preparation, and Development	14	50	64	93	121
Resource Efficiency	4	43	59	89	119
Energy Efficiency	46	30	60	80	100
Water Efficiency	4	25	39	67	92
Indoor Environmental Quality	27	25	42	69	97
Operation, Maintenance, and Building Owner Education	5	8	10	11	12
Additional Points from Any Category	n/a	50	75	100	100
Total Points	100	231	349	509	641

Source: Points and categories based on the National Green Building Standard, ICC 700-2012, approved by the American National Standards Institute on Jan. 10, 2013.

Propane Pays in More Ways than One

Energy rebates are one of the most compelling sales pitches to prospective customers, and propane appliances qualify for a number of federal, state, local, and cooperative incentives. As a builder, remodeler, or HVAC professional, you should understand the full range of credits or rebates you can use to help homeowners get the most from their energy dollars. In some cases, both you and the homeowner can qualify for multiple rebates on a single project.

For more information on tax credits, rebates, and other incentives, visit dsireusa.org, buildwithpropane.com/rebates, and your local propane retailer.

Type of Rebate or Credit	Learn More
<p>Federal, state, and local government incentives The federal government, along with some states and localities, provides tax credits, rebates, grants, and other incentives for propane projects.</p>	<p>dsireusa.org</p>
<p>State, regional, and local propane association rebates may also be available for energy-saving propane appliances.</p>	<p>buildwithpropane.com and your local propane retailer</p>

Five Ways to Further Boost Your Propane Smarts

Get free online training. The Propane Education & Research Council (PERC) provides an online Propane Training Academy full of free courses that can help enhance your new construction or remodeling projects with propane applications. Learn more at buildwithpropane.com/training.

Earn continuing education credits. Many PERC-sponsored online courses are approved for continuing education credit with leading trade organizations, including the American Institute of Architects (AIA), the National Association of Home Builders (NAHB), the National Association of the Remodeling Industry (NARI), and the U.S. Green Building Council (USGBC). For more information, go to buildwithpropane.com/training.

Sign up for e-newsletters. Stay up-to-date with the latest propane news, including available rebate and incentive programs. To receive the Propane Energy Update each month, go to buildwithpropane.com/subscribe.

Access new research. Get breaking news in energy research, new technology updates, and business-building thought leadership. Go to [buildwithpropane.com > Research](http://buildwithpropane.com/Research).

Use The Propane Technical Pocket Guide. As a more detailed companion to this brochure, The Propane Technical Pocket Guide provides added technical and performance-related information on propane. Download a copy for you and your subs at buildwithpropane.com.

Training and Safety: An Ideal Combination

PERC promotes the safe, efficient use of propane as a preferred energy source. Since its creation in 1998, PERC has invested millions of dollars in an ongoing effort to enhance propane safety with building professionals and consumers. A key factor in the success of these programs has been the development of the Propane Training Academy, which provides builders, remodelers, and other skilled construction professionals with practical, straightforward online courses. These training modules, which cover everything from topic overviews to specific installation tips, are designed to help you expand your use of propane applications in safe and efficient ways. Learn more at buildwithpropane.com/training.

Available Certifications



American Institute of Architects [AIA]

The Propane Training Academy currently offers a variety of courses that are approved by the AIA Continuing Education System. All active, registered AIA members must successfully complete 18 learning units [LUs] per year. Of this total, 12 must meet the Health, Safety, and Welfare [HSW] criteria. Learn more at aia.org.



National Association of Home Builders [NAHB]

The Propane Training Academy currently offers several courses that can help professionals earn continuing education credits to maintain their NAHB designations. Each of the NAHB's designations has its own unique requirements, including years of experience, required courses, and exams. The same is true for maintaining previously earned designations. Learn more at nahb.com.



National Association of the Remodeling Industry

The Propane Training Academy currently offers a variety of courses approved for NARI continuing education units. Each NARI-approved module at the Propane Training Academy qualifies for one NARI CEU Hour. Learn more at nari.org.



U.S. Green Building Council

The Propane Training Academy currently offers many courses approved for U.S. Green Building Council [USGBC] continuing education and training credits. USGBC is the source for Leadership in Energy and Environmental Design [LEED] standards updates and is a leader in the sustainable building field. Learn more at usgbc.org.



A FIVE-PART PLAN TO LOWER HERS RATINGS

The Numbers

Builder: Mishler Builders

Size: 3,500 square feet

Location: Hunt County, Texas

Energy Package: Propane Energy Pod

HERS Index: 51

Annual Cost Savings: \$1,154

CO₂ Emissions Reduction: 8.1 tons



THE CHALLENGE: TOP-NOTCH ENERGY EFFICIENCY.

When builder Mike Mishler and his client John Cadenhead set out to construct a custom home in Hunt County, Texas, they were resolute about making the 3,500-square-foot home as energy efficient as possible.

THE SOLUTION: THE PROPANE ENERGY POD.

Mishler and Cadenhead's energy-efficiency strategy combined a fully sealed home envelope with the Propane Energy Pod, a model for new construction that treats a home's five key areas of energy use — space heating, water heating, cooking, fireplaces, and clothes drying — as parts of a whole-home energy package. It's a solution that achieved remarkable, and measurable, performance: The home's HERS Index rating of 51 equates to annual savings of \$1,154 on energy bills and 8.1 tons of CO₂ emissions.

Find more real-world examples of Propane Energy Pod success stories at buildwithpropane.com/energypod.



Scan this code to connect to interactive tools, training, and videos.



GARAGE

POOL

SPA

OUTDOOR LIVING

SCREEN PORCH

MASTER BATH

MASTER BEDROOM

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