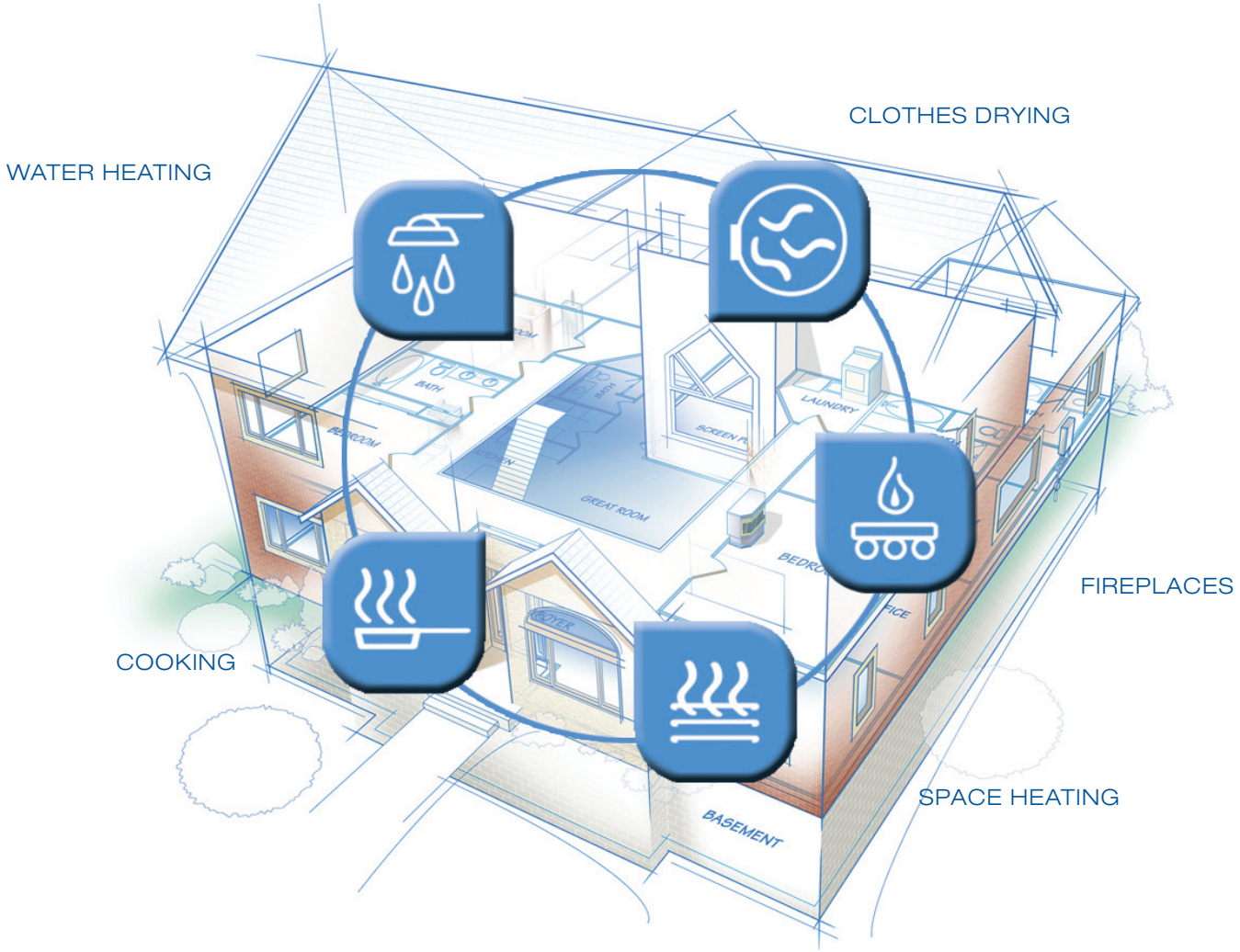
# Propane Energy Pod Solution for New Homes




Bundles or collections of building systems in homes can form the basis of an energy package or "pod." These can be the foundation for homes delivering energy and $CO_2$ emissions savings that outperform typical new homes in the marketplace. In this project, Newport Partners researchers used building energy analysis to evaluate the energy and environmental performance of a series of Propane Energy Pod prototype homes at two sizes, across different climate zones. These results were compared with standard homes with typical technology packages.

Each Propane Energy Pod home comprised five residential energy-use loads, as shown in the illustration. These loads represent five prominent energy end uses in a home. Optimizing their performance can have a significant impact on energy costs and $CO_2$ emissions.

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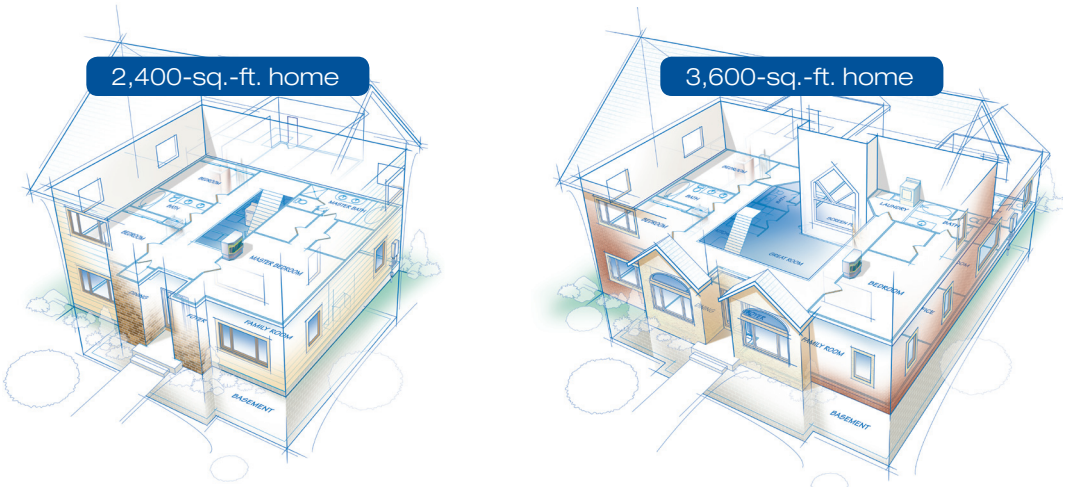



## METHODOLOGY

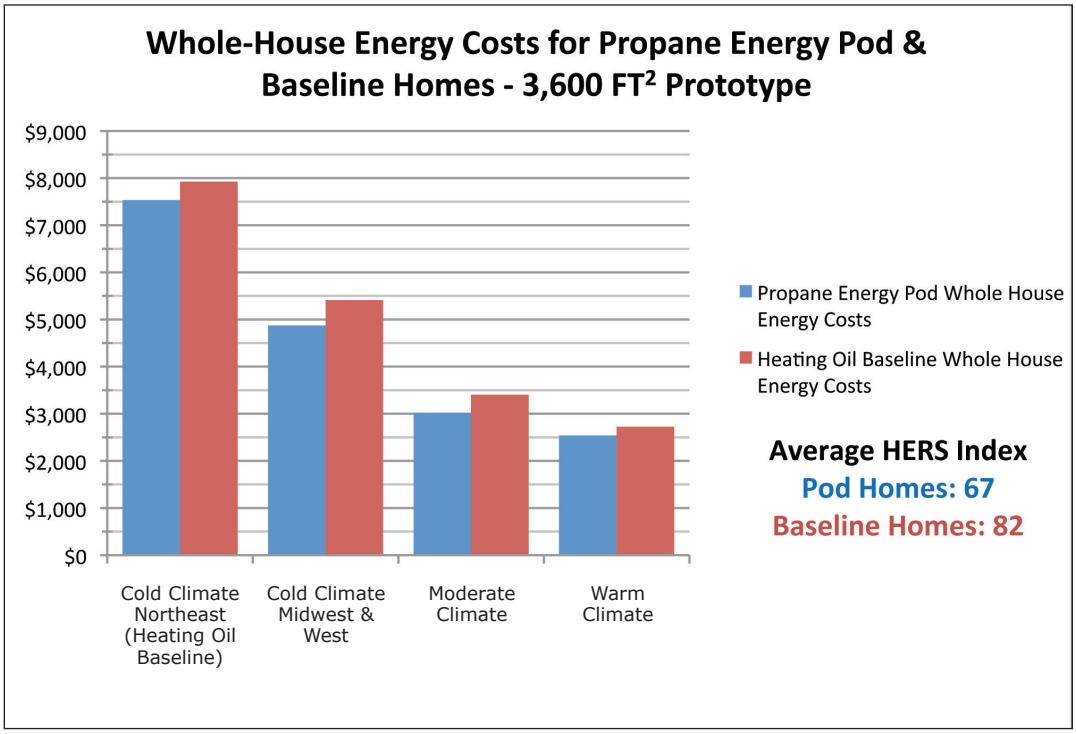
The specifications for the technologies within each Propane Energy Pod home were based on current product offerings as well as the climate. For example, in the Cold Climate Propane Energy Pod home, the specified heating system was a 97 AFUE forced-air furnace — making it eligible to receive Energy Star's "Most Efficient" designation — while in the Moderate Climate Propane Energy Pod home, where heating demand is not as high, a dual-fuel system using a high-efficiency heat pump with a high-efficiency propane furnace back-up was specified. The specifications for cooking, fireplaces, and clothes drying were based on data from DOE analyses and market data for both the propane systems and the standard (electric) systems. In the standard homes, electric systems were specified for space heating (air-source heat pump) and water heating (electric storage tank water heater) as well as for cooking, fireplaces, and clothes drying. One exception was analysis locations in the Northeast, where the space heating system was a heating-oil-fired furnace. In all cases, space and water heating systems in the standard homes were set at current federal standards.

The energy and environmental performance of the Propane Energy Pod homes and the standard homes were modeled in 16 different locations throughout the United States for two prototype new homes: one at 2,400 square feet and another at 3,600 square feet. The technologies modeled in the two prototypes were consistent, with the main differences being the number of systems and the size (capacity) of the systems. For example, the 3,600-square-foot house, which represents a typical custom home, had two heating systems, while the 2,400-square-foot prototype had one. Other building characteristics of the Propane Energy Pod homes and the standard homes — such as foundation type, wall insulation levels, and number of stories — were based on data from the Energy Department's Energy Information Administration (EIA), the U.S. Census Bureau, and the 2009 International Energy Conservation Code (IECC).

The energy costs for propane, electricity, and heating oil were derived at the state level from EIA prices reported for 2010. The factors used to calculate $CO_2$ emissions were sourced from EPA's eGRID2012 Version 1.0 database.

## ENERGY & ENVIRONMENTAL ANALYSIS RESULTS

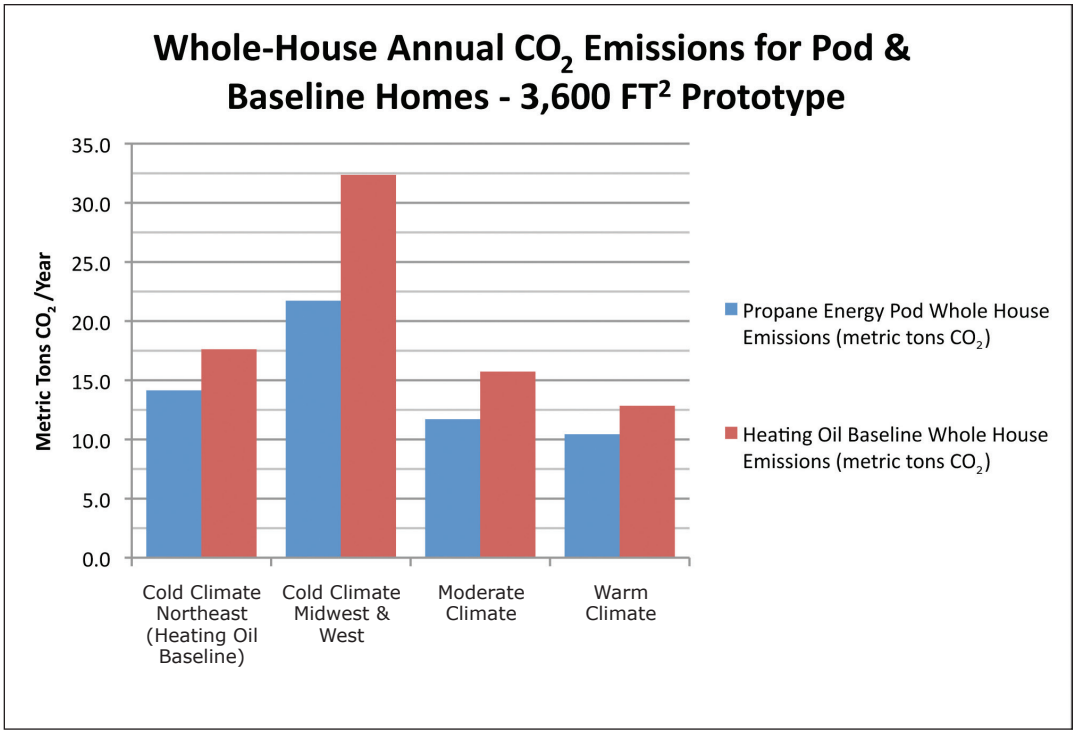
The end result of this energy and environmental analysis was data that reflected whole-house energy use, energy costs, and annual $CO_2$ emissions data for both the Propane Energy Pod homes and standard homes in each climate region. Home Energy Rating System (HERS) Indexes were also generated for each analysis location. (The HERS Index is a system that measures the energy efficiency of a home on a scale of 0 to 100; the lower the score the better.) A bar chart depicting energy costs across the four climate zones and HERS results for the 3,600-square-foot home is shown below.




As the chart illustrates, annual energy costs for the Propane Energy Pod homes ranged from 5 percent (Cold Climate — Northeast) to 11 percent (Moderate Climate), lower than for the standard homes. In the other three regions, the Propane Energy Pod homes averaged about $374 less in annual energy costs than for the standard homes when modeled for the 3,600-square-foot prototype. For the 2,400-square-foot prototype, the annual energy costs were also lower in the Propane Energy Pod homes by an average of $174 across all 16 locations.

The graph above also notes the average HERS Index for the Propane Energy Pod homes and the standard homes. The average HERS Index of 67 for the Propane Energy Pod homes indicates that the homes are roughly 33 percent (100 minus 67) more efficient than a standard code-compliant home, while the standard homes are estimated to be about 19 percent (100 minus 81) more efficient. A variety of energy-efficiency labeling programs uses the HERS Index as a metric, with threshold levels often in the range of 70 to 80. Several national production builders have begun labeling all of their new homes with a HERS Index.

The $CO_2$ emissions of the Propane Energy Pod homes were found to be significantly lower than for the standard homes, with "pod" homes emitting 5.1 metric tons less $CO_2$ annually (see graph above). This efficiency is equivalent to removing one passenger car from the road for every year that the Propane Energy Pod home is in use.




## ADDITIONAL APPLICATIONS BRING ADDITIONAL BENEFITS

The five applications of the Propane Energy Pod are core to a home's energy savings and low-emissions profile — valuable features in any home, for any market. But builders should consider making simple design and installation steps during construction to prepare a home for additional propane features — such as backup power generation, garage heating, snow melting, and outdoor living — in excess of the five applications contained in the Pod model. Doing so greatly reduces retrofit costs, should the homeowner decide to add those applications in the future.

| Application | Steps to Take During Construction | Benefits |
|---|---|---|
| Whole-Home Backup Power Generation | 1. Pre-plan location for generator within 10 feet of gas line.<br>2. Install generator-ready electrical panel.<br>3. Install tee in gas line prior to other splits. | 1. Reduces installation cost by about $3,000.<br>2. Ensures optimal generator placement.<br>3. Avoids reworking mechanical system fresh-air intakes. |
| Garage Heating and Snow Melt | 1. Install and cap radiant tubing within garage slab, driveways, and walkways.<br>2. Install below-slab insulation per local code or design guidance.<br>3. Run and label capped propane line to future location of wall-mounted garage heater. | 1. Greatly reduces cost of adding a garage heating or snow-melt system. |
| Outdoor Cooking, Fireplace, Patio Heating, Lighting, and Insect Control | 1. Plan location of applications.<br>2. Provide capped and labeled distribution manifold. | 1. Simplifies connection to existing plumbing lines.<br>2. Reduces cost of labor associated with design and installation. |

## FOR MORE INFORMATION

To learn more about the reliability, efficiency, and performance of propane appliances, contact the Propane Education & Research Council at 202-452-8975 or **propanesupport@propanecouncil.org**.