Combination Space/Water Heating Systems

Energy Efficiency for Manufactured Homes

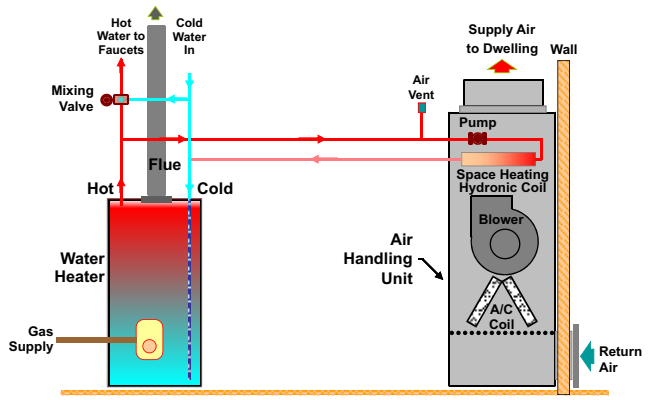
As American families struggle with the rising cost of housing, a manufactured home is often the most attractive path to home ownership. Approximately 18 million Americans (over seven percent of the U.S. population) live full-time in 7.3 million HUD-Code manufactured homes. In 2004, more than 130,000 units were shipped nationwide. Low purchase costs, demographic changes, faster construction times, and improved construction quality have made manufactured homes an important segment of the residential housing market.

While homeowners are increasingly satisfied with the manufactured home environment, a recent nationwide survey conducted by Foremost Insurance Company revealed an important drawback: energy-related comfort. Manufactured homes with heat pumps are characterized by many home owners as being difficult to heat. Also, high energy costs associated with resistance heating appliances can offset the inherent savings of a manufactured home with exorbitant energy bills, even to the point where the utility costs exceed the mortgage payment. Integrated combination space/water heating systems (combo systems) represent a substantial opportunity for energy efficiency improvement that will lower monthly expenses for homeowners, increase the value of their investments, and improve the quality of their lives.

Combo Systems: Efficient and Affordable

The last 20 years have seen the installation of combination space/water heating appliances in over one million stick-built homes. Effective in operation and simple in concept; combo systems use a propane-fueled hot water heater (already noted for reliability) for both water and space heating. When room temperatures drop below the desired threshold, hot water is circulated to a heat-exchanger coil. A blower draws air over the coil and through ducts to warm the house, and the water returns to the hot water heater.

Configuration of a Typical Combo System



While today's combo systems are proven in conventional housing applications, the systems do not meet the unique cost and limited-space requirements of manufactured homes. The Propane Education & Research Council (PERC), Alabama Gas Company, and the U.S. Department of Energy (DOE) are co-funding the development and production of a combo system specifically designed for use in manufactured homes through DeLima Associates of McLean, VA. PERC is providing $300,000 in funding (**Docket 11110**) for the development portion of this project.

Combo System Benefits

With propane as their energy source, combo systems provide a variety of benefits over traditional systems that consist of stand-alone furnaces and water heaters:

- High energy efficiency
- Space savings
- Low operating costs
- High load factor
- Improved comfort
- Reduced water-heater jacket losses

"This initiative is another example of the propane industry's commitment to, and partnership with, the manufactured housing industry."

- Kate Caskin,
Senior Vice President, PERC

Development of the Combo System

The project objective is to design and produce an efficient, integrated appliance for space heating/cooling, water heating, and air distribution in manufactured homes. Initiated August 2004, this project promises a viable product with a ripe market and remarkable benefits. The 30-month work plan includes three of the following five stages:

1. **Exploratory Development (Months 1-7)** —Bench and laboratory test the combo system hardware to ensure that components and subassemblies meet performance projections for manufactured housing.
2. **Advanced Development (Months 7-15)** —Build and test a working prototype of the combo system.
3. **Engineering Development (Months 14-30)** —Build field test units, conduct field tests, and construct pre-production units for testing.
4. **Demonstration**—Place the combo systems in two manufactured homes to obtain end-user validation of the system.
5. **Implementation**—Build and sell 3000 combo systems in the first year of production.

Draft-Free Comfort

Conventional Proposed

The new combo systems distribute air through small-diameter ducts. Unlike conventional systems which often leave hot and cold spots throughout the home, streams of air enter a room and gently mix with existing air currents. From floor to ceiling, air temperatures are even and drafts eliminated. Air distribution systems based on this concept are currently available through the HVAC project partner, Unico, Inc.

Energy Savings Covers the Cost

When energy-related appliances are installed at the factory, first-costs are borne by the manufacturer and incorporated into the monthly mortgage payments. This allows the purchaser of a manufactured home to consider more expensive but energy-efficient options, such as a combo system. Even though monthly mortgage payments are increased slightly by the installation of a combo system, a comparable system composed of a separate electric water heater and electric furnace can cost up to twice as much to operate. As a result, the increase to the mortgage and low operating cost are more than offset by the savings to the utility bill.

Future Plans

Upon successful commercialization, the integrated combination space/water heating concept will be extended to other applications where space and costs are also critical concerns, including:

- Modular and panelized homes
- Public housing
- Multifamily housing
- Condominiums

Market Potential

Combo systems have the potential to increase propane sales by 1.75 million gallons in their first year and promise to expand the year-round use of propane dramatically for years to come. The inherent ease of use, effectiveness, and efficiency of propane will lead to further appliance applications traditionally held by electricity. The advent of the combo system will pave the way for an increased market for propane in cooking, refrigeration, drying clothes, barbecuing, lighting, and fireplace uses.

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