CAPITAL REGIONAL DISTRICT
Water Services

Demand Management
Research Brief

On-Demand Hot Water Systems

Overview


Photo: www.toolbase.org

On-demand, or tankless, water heaters are common in Asia and Europe, and their use has been increasing in North America since about 1980. Unlike conventional tank water heaters, tankless water heaters heat water only as it is used. A tankless unit has a heating device that is activated by the flow of water when a hot water valve is opened. Once activated, the heater delivers a constant supply of hot water. The output of the heater, however, limits the rate of the heated water flow. Tankless heaters are available in propane (LP), natural gas, or electric models. They come in a variety of sizes for different applications, such as a whole-house water heater, a hot water source for a remote bathroom or hot tub, or as a boiler to provide hot water for a home heating system. They can also be used as a booster for dishwashers, washing machines, and a solar or wood-fired domestic hot water system.


Photo: www.toolbase.org

Recirculation pump systems are also often called on-demand hot water systems. These systems use small pumps and looped hot water piping to continuously recirculate hot water between a conventional hot water tank and points of use such as faucets, baths and showers so that hot water is immediately available when the fixture is used. Such systems are common in industrial, commercial and institutional facilities.

On-demand hot water systems are often promoted as energy conservation technologies. Tankless systems can save energy by heating water only when hot water is needed, eliminating the standby heat loss from hot water tanks. Both tankless and recirculating systems and are also sometimes claimed to reduce water usage because it is not necessary to run water through taps before it is warm enough to be used.

Applications

A tankless water heater may be installed centrally or at the point of use, depending on the amount of hot water required. A small electric unit may be used as a booster for a remote bathroom or laundry. These are usually installed in a closet or underneath a sink. The largest gas units, which may provide all the hot water needs of a household, are installed centrally. Gas-fired models have a higher hot water output than electric models of similar size. As with many tank water heaters, even the largest whole house tankless gas models cannot supply enough hot water for simultaneous, multiple uses of hot water (i.e., showers and laundry). Large users of hot water, such as the clothes washer and dishwasher, need to be operated separately. Alternatively, separate demand water heaters can be installed to meet individual hot water loads, or two or more water heaters can be connected in parallel for simultaneous demands for hot water. Some manufacturers of tankless heaters claim that their product can match the performance of any 40-gallon (151-liter) tank heater.

Recirculation systems can be purchased as retrofit kits that install under a bathroom sink using and operate at the push of a button (causing the pump to pump water from the hot water pipe to the cold water pipe until hot water arrives at the fixture). Installations in new homes or commercial applications include dedicated return piping to circulate hot water in a continuous loop past several fixtures before returning it to the tank.

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Performance

On-demand hot water systems have not been found to significantly reduce water usage in residential applications. The available literature is summarized in the following excerpt of the California Urban Water Conservation Commission "H2ouse" website:

On-Demand Hot Water System Water Savings

There are several types of on demand hot water systems including: recirculating systems, demand type pump systems, thermo-siphon systems, and point-of-use water heaters. These systems may or may not save water in your home depending, upon your specific situation and the type of system you install.

Few studies have evaluated the water saving potential of these devices. A 2000 study in Westminster, Colorado evaluated on demand hot water systems in six homes and in a group of control houses (Mayer and DeOreo, 2000). This study found evidence of reduced shower usage in the six homes with the on demand systems. However, these six homes used more water for baths than did the control group. The combined shower and bath usage was identical between the two study groups. The study concluded that there was "no statistically verifiable overall savings" associated with the on demand hot water systems, either because of the effectiveness of the systems or because of the small sample size.

A recent unpublished study in San Jose, California evaluated on demand hot water systems in about ten single-family houses (de la Piedra, 2001). This study found very limited water savings in the study homes that were substantially less than the manufacturer had claimed.

If these devices are included as part of comprehensive water conservation programs they must be shown, through independent evaluation, to save water. At this point water saving potential of on demand hot water systems is uncertain.

Source: California Urban Water Conservation Council (www.h2ouse.org), 2006

Potential water savings depends on system configuration. In theory, if hot water is immediately available at every point of use in a home no water is wasted by running taps or showers while waiting for the water to heat up. It is possible that this volume of water will be significant in a large home or commercial application where the distances from a central water heater to points of use are long and large copper pipes are used. In such cases, the energy savings achieved by using some combination of tankless heaters and recirculation systems, in combination with insulated pipes, will likely justify the added cost of such systems, and significant water savings may be achieved as well.

References

Mayer, Peter et.al. *Show me the Savings! Do New Homes use Less Water?* Aquacraft Inc., Boulder, CO. Undated, ca. 2000.

Performance Comparison of Residential Hot Water Systems. National Association of Home Builders Research Center, Inc., Upper Marlboro, MD. 2002.

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