On-Demand Water Heating Systems

What is an On-Demand Water Heating System?

Unlike conventional water heating systems that hold hot water in a tank, on-demand (or "instantaneous") water heating systems are tankless units that heat the water only when it is used. In other words, the tankless system's heating device is activated only when it detects the flow of water from a hot water valve being opened. Once the heating device is prompted, a constant supply of hot water will begin to flow. This type of on-demand water heating systems (used in homes or commercial buildings) is available in propane, natural gas, and electric models.1

More common in commercial settings are recirculation pump systems. These systems work by using small pumps combined with a looped system of hot water piping to constantly recirculate hot water from a conventional tank to points of common usage such as faucets.

Both of these systems are considered energy-conserving technologies because they eliminate the standby heat loss from conventional hot water tanks by heating water only when hot water is demanded. This saves energy and can reduce water usage because these systems don't require the need to run water for a period until it gets warm.

Additionally, while not a type of on-demand heating system, solar water heating systems are another effective way of reducing utility bills while being more environmentally conscious. More information can be found here:

http://www.wbdg.org/resources/swheating.php

Conventional commercial water heaters account for roughly 11% of the total energy load consumed in commercial facilities. Thus, it is important to conduct an energy audit of your facility to help determine what your water needs are, including: usage times, amount

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of water used, temperature range, and flow rates. Determining these needs will help you make a decision about the best heating system model to use in order to reduce energy consumption and save money on utility bills.

**How to Incorporate an On-Demand Water Heating System**

Commercial facilities generally require a complex form of water delivery system. Sites that would benefit most from using an instantaneous water heating system are buildings that have consistent water heating loads. Looking at the facility holistically, as well as hiring a professional, will help in choosing the right on-demand water system and help save on utility costs.

On-demand water heaters can be installed at a central location in the building or at a specific point of use. This decision depends upon the amount of hot water that is required. For example, a small electric on-demand water heating system can be installed in a bathroom or laundry room to supply hot water needs for that specific location. A large gas-fired unit can be installed at a central location that can supply all the hot water needs for a small commercial facility. Gas-fired models are used centrally because they provide higher outputs of hot water than electric models.

**Example**

**Smokey Bones Restaurant in Buffalo, NY: Installation of Commercial Tankless Water Heaters**

Two nearly identical full service Smokey Bones Restaurants in Buffalo, NY needed water heating systems. One location installed high-efficiency commercial heaters and the other installed efficient tank type water heaters.


**Benefits**

Tankless on-demand water heaters have several benefits over a conventional tank system. While a conventional system may have a typical efficiency rating of 40%, tankless systems can have an efficiency rating of 80% or more. This efficiency percentage is

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based upon combustion efficiency as well as standby losses. The higher the efficiency rating, the fewer standby losses the system will incur. Additionally, if 50% energy savings are achieved by switching to an on-demand water heating system, payback periods can be attained in 3-5 years.\(^4\) It should also be noted that new commercial buildings have an advantage when installing on-demand water heating systems because pipe replacement is not needed. The piping can be implemented when the building is built, therefore eliminating the need for possible expensive replacement pipes.

**Costs**

The Federal Energy Management Program (FEMP) provides an example of a cost-effective water heating system:\(^5\)

<table>
<thead>
<tr>
<th>Performance</th>
<th>Base Model(^a)</th>
<th>Required</th>
<th>Best Available(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Factor (EF)</td>
<td>0.59</td>
<td>0.62</td>
<td>0.85</td>
</tr>
<tr>
<td>Annual Energy Use (therms/year)</td>
<td>254</td>
<td>242</td>
<td>176</td>
</tr>
<tr>
<td>Annual Energy Cost</td>
<td>$152</td>
<td>$145</td>
<td>$106</td>
</tr>
<tr>
<td>Lifetime Energy Cost(^c)</td>
<td>$1,385</td>
<td>$1,320</td>
<td>$960</td>
</tr>
<tr>
<td>Lifetime Energy Cost Savings</td>
<td>—</td>
<td>$65</td>
<td>$425</td>
</tr>
</tbody>
</table>

\(^a\) The efficiency of the Base Model is the minimum allowed by current US DOE appliance standards.

\(^b\) More efficient products may have been introduced to the market since this specification was published. Performance data for the Best Available model was obtained from the November 2005 GAMA directory (see For More Information).

\(^c\) Lifetime Energy Cost is the sum of the discounted value of annual energy costs based on average usage and an assumed water heater life of 13 years. Future electricity price trends and a discount rate of 3.0% are based on federal guidelines (effective from April 2005 to March 2006).

**Cost-Effectiveness Assumptions**

In the example above, the Base Model is a 40 gallon storage tank water heater with an Energy Factor (EF) of 0.59, the required water heater is a 40 gallon storage-type with and EF of 0.62 and First Hour Delivery (FHR) of 70 gallons, and the Best Available is an on-demand-type water heater with an EF of 0.85 and flow rate of 4.0 gallons per minute (First Hour Delivery or FHR > 70 gallons). Energy Factor is an efficiency ratio of the

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energy supplied in heated water divided by the energy input to the water heater. Annual energy use in this example is based on the standard DOE test procedure and calculated assuming an inlet water temperature of 58°F, a set point of 135°F, daily hot water demand of 64 gallons, and 365 days per year of use. The assumed gas price is $0.60 per therm, the average at federal facilities in the US.


For calculating different energy prices and standards, FEMP provides a cost calculator that can be found here: http://www1.eere.energy.gov/femp/technologies/eep_waterheaters_calc.html.

Resources

NJ’s Clean Energy Program
http://www.njcleanenergy.com/commercial-industrial/home/home

Technology Options and Commercial Water Heater Manufacturers
http://www.fypower.org/com/tools/products_results.html?id=100208

Instantaneous Gas Water Heaters Fact Sheet