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On-Demand Water Heating – Is it the best solution for your home?

During the past several years we have fielded hundreds of calls regarding the use of on-demand water heaters. Widely used in Europe and Asia, these appliances have begun to penetrate the American market, largely due to marketing campaigns by manufacturers and the efforts of “green building” advocates. Although on-demand water heating can be a perfect fit in certain applications, it may not be the best solution in every project. We have written this guide to help the end-user determine if it is right for them.

There are (2) significant advantages to on-demand water heaters. First, they provide significant energy savings due to their lack of “stand-by losses”. The second advantage is the minimal floor space required by these water heaters versus traditional storage water heaters.

“Stand-by losses” occur in traditional storage water heaters in (2) ways. First, there is a pilot light that stays lit all the time. The cost of energy to run this pilot light is minimal. When operated with natural gas, it is as little as \$3.00 per month. The second, and more significant, source of “stand-by losses” is the hot air rising through the internal flue of the water heater, escaping through the chimney. Since storage water heaters cannot be insulated at the central chimney, these losses are significant. We estimate the cost of these “stand-by losses” through the flue at approximately \$20.00 per month for a (40) gallon water heater. Typically, storage water heaters operate at (60)% efficiency, meaning that (60)% of the energy is transmitted into hot water used by the consumer and (40)% of the energy is dissipated through the chimney. On-demand water heaters operate at 83% to 95% efficiency. Therefore, the energy savings of an on-demand water heater using natural gas ranges from \$15.00 to \$20.00 per month. If one is using LP gas or electricity to heat water, this dollar amount would rise by a factor of (3) or (4).

The second advantage of using on-demand water heating is the small size of the units themselves. On-demand water heaters are typically wall mounted, leaving the floor free for other uses. Best of all, they can be installed outside, exposed to any weather. This is perhaps the most important advantage of these appliances, as everybody knows the value of Santa Barbara real estate.

Disadvantages of On-Demand Water Heaters:

1. Initial cost
2. Higher demand for gas
3. Expensive combustion venting
4. Limited flow capacity
5. Maintenance expenses
6. Incompatibility with Radiant Heating and Solar Water Heating Systems.

1) Initial Cost:

The initial cost for an on-demand water heater that will deliver (6) gallons per minute, enough to serve (2) bathrooms, is around \$1400.00 with all the appurtenances. This compares to \$600 for a storage water heater. When one adds in the extra rough piping cost (we explain these costs in the next 2 sections), the price ranges from \$2500 to \$3500 to replace an existing storage water heater with a new on-demand water heater.

At \$20.00 a month in savings using natural gas, one's monthly savings in energy cost may never be repaid, given the depreciation of the equipment.

2) Higher Demand for Gas

On-demand water heaters have a typical gas usage load of 199,000 BTU's. Storage water heaters have a typical gas load of 40,000 BTU's. The reason for this discrepancy is that storage water heaters can reheat water slowly over an extended period of time, while on-demand water heaters must heat all the water being used instantly. The problem in retrofitting is that storage water heaters typically are served by a (1/2)" gas line, whereas on-demand water heaters usually need at least a (1)" gas line. Although this is not a big problem in new construction, it is expensive to retrofit gas piping in an existing location.

3) Expensive Combustion Venting

Storage water heaters use what are called "B-vents". This material is designed to withstand high heat, but not the corrosive acids that are typically generated by the exhaust in high efficiency appliances. On-demand water heaters require special stainless steel or PVC venting designed less to withstand high temperatures than to resist the acids generated in the efficient combustion process. As a result, any retrofit involves changing the vent that extends from the water heater up through the roof. This is an expensive process, typically costing between 500 and 1000 dollars. This is also a big incentive to install on-demand water heaters on the outside of the building, where no vent piping is required and it can vent directly to the exterior. Again, this is not a problem with new construction.

4) Limited Flow Capacity

A typical on-demand water heater has maximum flow-rate of 6.5 gallons per minute. This means that one is limited in how many fixtures can be operated at the same time. As a rule of thumb, this limits on-demand water heaters to homes with 2 bathrooms. Even in that application, there is a possibility that this heater might shut down if (2)

showers are being taken and laundry is run at the same time. One can “piggy back” two or more heaters to increase this capacity, but that involves additional expense in gas piping and venting. Again, this is less of a issue in new construction than it is in existing conditions.

5) Maintenance Expenses

Traditional storage water heaters do not have a terrific maintenance record. However, they are inexpensive enough to be seen as disposable commodities. In Santa Barbara, a typical storage water heater lasts of 7 years and can be replaced for \$1200.00. We do not have long term maintenance histories with on-demand water heaters, but we doubt their performance will be any better than storage water heaters. In fact, we expect that they may have shorter life spans due to their higher rates of heat exchange and their sheer complexity. Water in Santa Barbara is highly corrosive and tends to wear things out very quickly. Manufacturers recommend yearly service to clear calcium and other minerals from on-demand water heaters. This service costs between \$150.00 and \$200.00. Some manufacturers shorten warranties if the home does not have a water softener.

6) Incompatibility with Radiant Heating and Solar Water Heating Systems.

New homes have begun to integrate energy-saving technologies into water heating and space-heating applications. On-demand heaters are difficult to use with solar-thermal water heating, as storage is critical if one wants to capture solar energy while the sun shines and use it later. It is also a poor choice for radiant heating, as the heat exchangers are not a perfect fit for the recirculating systems required in radiant applications.



Our conclusion regarding on-demand water heaters is as follows:

They are best used in smaller buildings with no more than 2 bathrooms. In addition, they are best installed on the exterior of the house where they don't need to be vented. Finally, they are best installed in new construction where one does not need to retrofit gas piping, hot and cold water stub outs and vent piping. Please keep in mind that if one is using LP gas or electricity rather than natural gas for fuel, these calculations change as the monthly energy savings are significantly higher.

In the last several years, we have begun to install “Super-efficient” stainless steel storage water heaters as a 3rd alternative in construction projects. Although expensive (\$5000 - \$7000.), they are 95% efficient, equal to the most efficient on-demand water heaters. These water heaters should last decades due to their stainless tanks. They also recover very quickly, meaning they reheat 2 to 3 times faster than traditional storage water heaters. They are relatively easy to vent, because they use PVC pipe. Finally, these heaters are a perfect fit for solar thermal and radiant heating. The “Phoenix” water heater can actually be ordered with an internal solar heat exchanger and/or an external radiant heat exchanger.