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On-Demand Water Heating – Is it right for you?

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 extensive marketing campaigns by manufacturers and the efforts of "green building" advocates. Although on-demand water heaters can be a perfect fit in certain applications, much of the information disseminated has been incomplete or down-right misleading.

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 $1.00 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 $10.00 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 about (84)% efficiency. This is much better, although less than the (94)% efficiency achieved in high-efficiency stainless steel storage water heaters. Therefore, the energy savings of an on-demand water heater using natural gas ranges from $10.00 to $15.00 per month. If one is using LP gas or electrical water heating, 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. Incompatibility with recirculating systems
6. Maintenance expenses

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 $1200.00 with all the appurtenances. This compares to $500 for a storage water heater. When one adds in the extra rough piping cost, the price ranges from $2500 to $3500 to replace an existing storage water heater with a new on-demand water heater. At $10.00 a month in savings using natural gas, one's monthly savings in energy cost will never by repaid.

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2) Higher Demand for Gas

On-demand water heaters have a typical gas usage capacity of 180,000 BTU's. Storage waters heaters have a typical gas capacity 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 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) Extensive Combustion Venting

Storage water heaters use what are called "B-vents". This material is designed to with - stand 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 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 in required and they can vent directly to the exterior.

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) Incompatibility with Recirculating Systems

Almost all new projects that we work on require recirculating hot water systems. This means that hot water is pulled by a pump from the last fixture in the house back to the water heater. This creates a continuous insulated loop of hot water that it is available quickly throughout the house. On-demand water heaters do not integrate well with recirculating systems for 2 reasons. First, they are subject to a "cold water sandwich". Because on-demand water heaters have a (6) second delay before firing up, a quart of more of cold water is injected in the system. This "cold-water sandwich" travels through the recirculating loop and jolts people in showers at the far end of the building. At first, the manufacturers refused to acknowledge that this was a problem, as they clearly had not encountered this in their smaller applications in Europe and Asia. Finally, they recommended the addition of a small electric water heater to bury the cold water sandwich within the loop so that the consumer would not notice the cold water injected into the system. Obviously, the inclusion of an electric water heater negates most (if not all) of the energy savings of an on-demand water heater. The second problem with recirculating systems is the complicated and costly piping involved in setting up the electric water heater and the bypass necessary to make the on-demand water heater function properly. Storage water heaters are designed to add recirculating systems easily and inexpensively.

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6) Maintenance Expenses

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 600 dollars. 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 will 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. Even the manufacturers recommend regular service to clear calcium and other minerals from on-demand water heaters. This service is recommended at least once a year and costs between 150 and 200 dollars.

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

There are best used in small buildings such as guest houses and cabanas where recirculating systems are not required. 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 somewhat as the monthly savings are significantly higher.