

TOOLBASESM TECHSPECS

Tankless Water Heaters

DOLLARS & SENSE

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TECH @ A GLANCE

BENEFITS (+) / DRAWBACKS (-)

- + **ENERGY EFFICIENCY:** 10-20 percent less energy usage than tank-type units
- + **AFFORDABILITY:** Reduced water heating bills for consumers; less floor space required; longer life
- + **MARKETABILITY:** Point-of-use or whole-house water heating; compact size; on-demand hot water
- + **DURABILITY:** Equipment has a longer life expectancy
- **AFFORDABILITY:** Initial cost is higher than conventional tank-type water heaters. Additional wiring or larger gas lines may be needed.

INITIAL COST

Initial cost of tankless water heaters is greater than tank-type water heaters. Initial costs can be offset by energy savings and longer equipment life.

OPERATIONAL COST

Tankless water heaters can last up to twice as long as tank-type water heaters, and will cost about 10 to 20 percent less to operate than standard tank water heaters.

CODE ACCEPTANCE

Water heating equipment is covered by the 2003 International Residential Code in Chapter 28 - Water Heaters, Chapter 20 - Water Heaters, and Chapter 24 - Gas Water Heaters.

RESULTS FROM THE FIELD

Several PATH field evaluations evaluated tankless water heaters for energy savings, performance, and installation issues.

WARRANTY

Warranties vary from 10-year limited to lifetime warranties, depending on the manufacturer.

MAKING THE SWITCH

It is relatively easy to begin using tankless water heaters. Units must be properly sized based on maximum anticipated hot water flow rate to meet peak demand. To do this, the contractor must determine maximum temperature rise (cold inlet to hot outlet) and typical maximum flow rate. For whole-house electric units, electricians must provide up to four, 30-amp circuits. Gas units typically require a power vent, and may need a separate gas supply. If a tankless water heater is to be used for a combined domestic water and hydronic heating system, trained and certified plumbers are necessary for design and installation.



THE BASICS

Tankless water heaters are compact heating units that provide hot water as it is needed, and do not store hot water like traditional tank-type water heaters. When a hot water tap is turned on, water enters the tankless water heater. A sensor detects the water flow, and activates an electric or gas heating device, which quickly raises the water temperature to a preset level. When water flow stops, the heating element shuts off. Thermostatically-controlled tankless water heaters vary their output temperature according to water flow rate and inlet water temperature.

Unlike traditional storage tank water heaters, tankless water heaters do not store a reservoir of hot water. As a result, standby losses are reduced, which makes them an energy-efficient alternative to traditional water heating. Tankless units can reduce water heating bills by 10 to 20 percent – a significant savings for homeowners, considering the average household spends 14 percent of its energy budget on water heating.

Gas and electric tankless water heaters are available in a variety of capacities by numerous manufacturers. They can be used for supplementary heat, such as a booster to a solar hot water system, or to meet all of a home's hot water needs. The maximum flow rate and temperature rise are determined by the capacity of the heater. In general, gas tankless heaters have larger capacities than their electric counterparts. Some tankless units may not be able to supply enough hot water for a

DOLLARS AND SENSE

Initial Cost: Tankless water heaters range in price from **\$200** for a small electric under-sink unit, **to over \$1,500** for a high-capacity, gas-fired unit. Installation costs can be slightly higher than tank-type units, depending on whether powered vents, PT valves, or large electric circuits are needed. The potential living space afforded by a tankless unit can be up to 9 square feet. At \$100 /s.f. this translates to \$900 of value.

Operational Cost: Tankless water heaters will cost about **10 to 20 percent less** to operate than standard tank water heaters. They also can last up to twice as long as tank-type water heaters. In most cases, these savings allow the homeowner to recover the additional unit cost in a short period of time. Beware of demand charges caused by the high instantaneous power draw that can erode cost savings.

In one PATH Field Evaluation, the unit cost was \$585 for a tankless water heater, compared to \$188 for a tank-type unit. The higher price tag was offset by **\$58/year in energy savings** since the tankless water heater used **23.6% less energy**; a **payback of 6.8 years**.

THE BASICS *continued*

home that has large draws or simultaneous use of hot water. In addition, units have lower capacity in cold climates where more energy is needed to raise water temperature.

Because tankless heaters do not store water, they are less subject to corrosion than tank-type heaters. As a result, their expected equipment life is longer – more than 20 years, compared with 10 to 15 years for traditional heaters. Also, because they are not under pressure, tankless water heaters are less susceptible to leakage than tank-type water heaters. However, in areas with hard water, scaling can build up in the heat exchanger and reduce energy efficiency over time.

Tankless water heaters are covered by the same code provisions as tank-type water heaters with the exception that they do not require a pressure and temperature (PT) relief valve. Local codes may require a PT valve, however. Gas tankless water heaters must be vented in accordance with local codes and manufacturers' specifications. A minimum gas pressure may also be required. Electric demand heaters may require additional electric service capacity and circuitry to accommodate the higher electric load.

RESULTS FROM THE FIELD

This technology has been evaluated by other builders in real-world building projects – learn from their experiences. For more information on these Technologies in Practice, visit www.toolbase.org.

Dallas, Texas, Carl Franklin Homes (PATH Field Evaluation)

- Side-by-side comparison of 55-gallon tank versus tankless electric water heating system in occupied, affordable home with whole-house water heater located in conditioned attic
- Tankless water heater cost \$585 compared to \$188 for tank-type heater; annual energy savings were calculated to be 730 kWh/year or, using local rates, \$58/year for the tankless heater, a payback of 6.8 years
- Efficiency of tankless system was 95%; tank-type system was 84%; standby energy loss was 0.2 kWh/day for tankless heater; 1.2 kWh/day for tank heater
- Builders' existing plumbing and electrical contractors performed design and installation; some requirements, such as location, were different for the tankless water heater, but the installation was largely the same as conventional
- Occupants generally pleased with performance of tankless heater; unable to determine which heater was in use

Tucson, Arizona, John Wesley Miller Companies (PATH Field Evaluation)

- Compared electric tank water heater to combination solar with tankless water heater for single owner-occupant. Homeowner reported no noticeable difference in system performance
- Solar energy supplied 60% of the hot water, energy savings were 66% over tank system
- Installed cost of combination solar/tankless system was \$3,300 compared to \$450 for the electric tank

Bowie, Maryland, MADE Homes (PATH Field Evaluation)

- Demonstration project of Marketable, Affordable, Durable, Entry-level homes
- 120-amp service required for electric tankless water heater; required larger 300-amp household service

MAKING THE SWITCH

What training, tools, and home design changes are required to switch from your current building practices to using this technology?

- **Learn to Choose the Right Size** – Tankless heaters must be properly selected based on the maximum amount of hot water to meet peak demand. To do this, the designer should determine needed temperature rise and desired flow rate. Many manufacturers offer calculators or other information for sizing purposes.
- **Take Advantage of the Space** – Tankless heaters consume a fraction of the space consumed by a tank heater. You can mount them in the same location as tank heaters, or you can rethink the location and take advantage of the smaller size in your home designs. In some cases, the use of several small tankless units can be used in the place of a whole-house unit. By placing the unit closer to the demand you can conserve water and energy.

FOOD FOR THOUGHT

This section provides some things to think about before switching to this building technology – make sure it's the right choice for you.

- Tankless water heaters are well suited to both new construction and retrofit.
- Lower capacity tankless heaters are ideally suited to homes with low to moderate hot water demand in warmer climates where more hot water can be produced because of moderate incoming ground water temperature. Manufacturers may recommend different plumbing configurations or multiple tankless units for homes with a consistently higher demand.
- Tankless units can be useful for an addition or new hot water use (e.g., bathroom) to avoid replacing the existing water heater. However, retrofit of electric units may be difficult or expensive due to inadequate electrical service panel size.
- Electric tankless units work well as back-up to a solar water heater. Their variable output is useful when raising water to the desired temperature from the variable solar input.
- Builders may want to consider that energy savings may be offset by another benefit – unlimited hot water supply.
- Simultaneous uses of hot water may be limited by tankless water heater capacity. Tubs may need to be filled slowly if the heater cannot keep up with hot water demand, since tubs generally fill at high flow rates.
- Point-of-use tankless heaters can be used to augment hot water supply for washing machines, kitchens, and remote bathrooms. The heaters provide hot water immediately at remote areas, which can save time and wasted water while waiting for hot water to reach a faucet.
- Electric tankless water heaters draw a lot more instantaneous power than tank-type electric water heaters. If electric rates include a demand charge, operation may be expensive.



MAKING THE SWITCH *continued*

- Consult the Local Codes – Find out if a pressure and temperature relief valve is required and if there are local venting or gas pressure requirements.
- Tools – You'll use the same tools you use to install tank heaters.
- Work with Your Trade Contractors - Review the product with your trade contractors to prepare for your first installation.

DEFINITIONS

Desired Flow Rate

Rate determined by listing the number of hot water devices expected to be open at any one time, and adding their flow rates.

Temperature Rise

Temperature established by subtracting the incoming water temperature from the desired output temperature. The incoming water temperature can be determined by calling the local water utility or checking the supply with a thermometer. Desired output temperatures are usually 120° F for most uses.

Stand-by Losses

Stand-by losses account for 10 to 20 percent of a home's annual water heating bill. They occur when heat is conducted and radiated from the walls of a hot water tank, or through the flue pipe in gas heaters.

TECH CHECK

Below is a checklist of steps to follow in order to implement this technology in each of your projects.

- Determine the role of the tankless unit(s) in the home.** Decide if the home will use a centrally-installed whole-house unit, multiple point-of-use units, or both. Tankless units can be the home's sole water heating source, or can be used to supplement traditional or solar water heating systems.
- Determine the home's water heating needs.** Water heater capacity should be determined to ensure that the right size of tankless water heater is selected to meet peak demand. Consult manufacturers or other resources to determine systems size.
- Assess initial cost versus operational cost and other benefits.** Compare higher initial costs for tankless units with operational cost savings from increased energy efficiency and longer life expectancy. Also consider benefits such as house-design flexibility and unlimited hot water supply.
- Select fuel type.** Installation considerations differ for electric and gas units. Electric units may require multiple circuits and in some cases, a larger service size. Tankless gas water heaters generally require a power vent, and may require a separate gas supply. Electric heaters generally cost more to operate than natural gas units. Propane units are also available.
- Communicate electrical and venting needs to electricians and plumbers who are trained and certified to install tankless water heaters.**
- Educate the Homeowner.** Provide the homeowner with information on the performance of the system, such as endless hot water, and lower utility bills. Additionally, provide basic information on operating the unit and a reputable contact who is familiar with the product to provide service if necessary.



The Partnership for Advancing Technology in Housing (PATH) is dedicated to accelerating the development and use of technologies that radically improve the quality, durability, energy efficiency, and affordability of America's housing. Managed by HUD, the PATH partnership includes the homebuilding, manufacturing, insurance and financial industries, and Federal agencies concerned with housing.

PATH addresses barriers to innovation, provides information on advanced building technologies, and advances housing technology research; making affordable, quality American homes a reality.

For more information on the PATH program, visit www.pathnet.org.

Tech Specs are Prepared for PATH by the NAHB Research Center.

RESOURCES

ToolBase Services

Information on this building technology and many others brought to you by PATH and the building scientists at the NAHB Research Center.
www.toolbase.org

Controlled Energy Corporation

340 Mad River Park
Waitsfield, VT 05673
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www.cechot.com

EEMAX, Inc.

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Oxford, CT 06478
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Englewood, CO 80110
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www.palomawaterheaters.com

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