

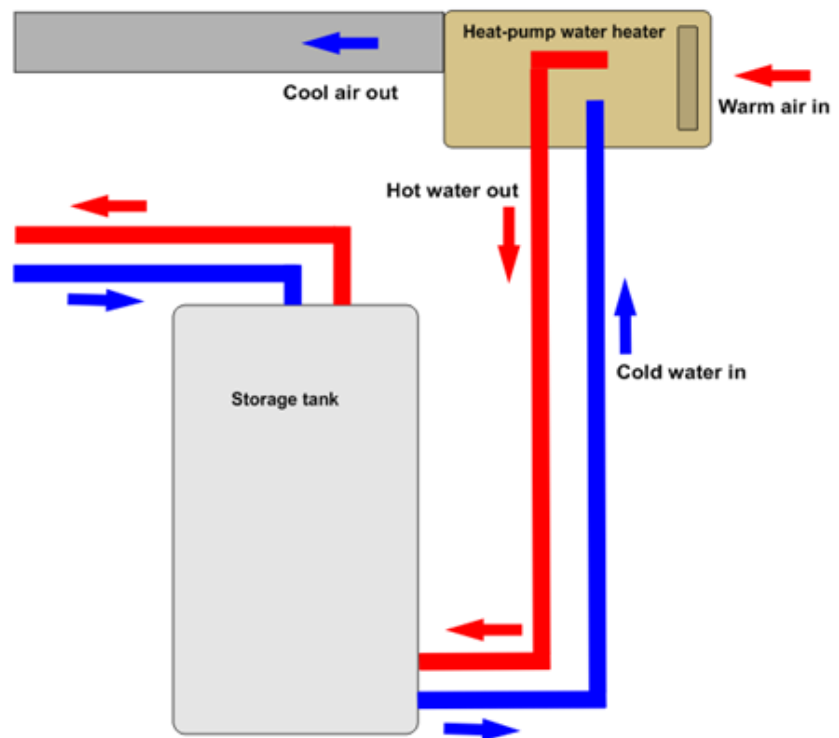
Hot Water, Cool Air, Less Energy Use

When heat pumps were first used for air conditioning, the hot air they rejected was considered a waste product. But that's changed. Air-to-water heat pump water heaters (HPHWs) use this "waste" hot air to heat potable water, using less energy than conventional gas and electric water heaters, as well as providing cool air for air conditioning without using additional energy.

Because heat pump water heaters use electricity to move heat from one place to another rather than generating heat directly, they can be two to seven times more energy-efficient than conventional water heaters, depending on the temperature of the waste heat source. That means that HPHWs can produce the same amount of hot water using less than half the amount of energy as conventional water heaters.

Heat pump water heaters extract latent and sensible heat from the ambient air, upgrade the heat with a compressor and refrigerant system, and transfer the heat into potable water.

Figure 1 is a schematic representation of how heat pump water heaters work.



Performance / Costs

Properly applied and installed, HPWHs save energy in almost every situation. Initial investment is recouped fastest for applications where waste energy is abundant, hot water use is high, and there is a steady need for the cool air generated as a byproduct.

Best energy savings occur when the HPWH is installed in an environment with mild or warm air temperatures, such as a laundry, kitchen, or building exhaust air stream. Because HPWH efficiency and capacity drop as the temperature drops, the best applications are where the ambient air is warm.

HPWH performance is measured by calculating the ratio of energy output to energy input. This is commonly known as the heating coefficient of performance (COP), which is the ratio of heat energy of the HPWH to the electrical energy input when both are in consistent units.

You may also see performance discussed as the Energy Factor (EF), which is the ratio of heat output to energy input measured during a specific 24-hour period. As mentioned earlier, heat pump water heater performance varies, but in typical use, HPWHs tend to operate with a COP of around 2 to 2.5 and can reach as high as 7.

Applications

Heat pump water heaters are ideally suited for the following applications:

- Buildings that need both hot water and air conditioning, such as restaurants and laundries
- Commercial buildings with an exhaust air stream
- Buildings with large, steady requirements for hot water
- Buildings with fairly steady need for air conditioning most of the year, such as offices, commercial and retail buildings
- Electrical control rooms
- Boiler rooms

Installation Considerations

Keep the following in mind when locating a heat pump water heater:

- HPHWs typically require location that remain in the 40-95⁰F range year around and provide at least 1,000 cubic feet of air space per ton of HPHW.
- HPHWs will not operate as efficiently in a cold space, although low-temperature HPHWs are available.
- System design configurations depend on whether heat is extracted from inside the building, from outside the building, or from exhaust ventilation air.