

## RESIDENTIAL WATER HEATING

## GAS HEAT PUMP WATER HEATER



## AT A GLANCE

- **Application:** Residential and light commercial water heating
- **Energy Savings:** ≥ 50% therm savings
- **Cost:** Equipment costs projected to be \$1,400 - \$1,800
- **Retrofit Installation:** Infrastructure upgrades avoided in majority of scenarios (e.g. pipe up-sizing)

## TECHNICAL DETAILS

- **Heat Output:** 10,000 Btu/hr
- **Firing Rate:** 6,300 Btu/hr
- **Tank Size:** 60 or 80 gallon format
- **Installation:** indoors or semi-conditioned space, such as a garage
- **Gas Piping:** ½"
- **Venting:** ½" to 1" PVC
- **Refrigerant:** 0.0 GWP, 0.0 ODP

## CALIFORNIA CASE STUDY

Five natural gas heat pump water heaters were installed in Los Angeles for 12+ months from 2018-2019. Here's what happened across these sites:

- **Performance:** Time-averaged COP<sub>gas</sub> of 1.2 -1.8 depending on conditions
- **Energy Saved:** reduction of 54% of water heating energy use
- **Emissions Reduction:** 49% reduction in CO2 emissions over baseline
- **Costs Avoided:** Average annual savings of \$111/yr from gas bill
- **Simple Payback:** Modeled results for the 16 California climate zones showed a range of 4.5-8 years
- **Homeowner Comfort:** All homeowners rated their experience with the gas heat pump water heater as moderate to excellent.

*Heat pump water heaters maximize energy savings from water heating in residential and light commercial applications.*

Approximately 75% of California homes using natural gas for water heating and 95% of these homes are served by minimum-efficiency products, an installed base of ~9 million units, with rated efficiencies of 60-65%. Higher efficiency (and higher cost) options are available – primarily tankless – with efficiencies ranging from 65% to 95%. Gas-fired heat pump water heaters (GHPWHs) have shown efficiencies of up to 130% or higher, resulting in significant energy savings.

Efficiencies above 100% are possible when utilizing a heat pump. In a recent demonstration, a vapor-absorption cycle was used to capture heat from the



tank. Combined with internal heat recovery, this maintains hot water capacity and temperatures while using significantly less natural gas. Vapor absorption heat pump cycles like this have been used for decades, but only recently have been applied to residential water heating.

Due to a compact combustion system with limited supplemental heating, GHPWHs can replace existing gas storage water heaters using existing ½" gas piping, a standard 15 A / 120 V circuit, and a low-profile ½" to 1" PVC vent. This avoids the cost of upsizing utilities which is often required for tankless gas water heater retrofits. Moderate installation costs combined with a lower lifetime operating costs can make this technology a good fit for homeowners with existing gas water heaters.

Single-family homeowners who hosted the prototype gas heat pump water heaters rated their experience as moderate to excellent. Four of five homeowners indicated they never ran out of hot water with the gas heat pump water heater.