



American Cities  
Climate Challenge

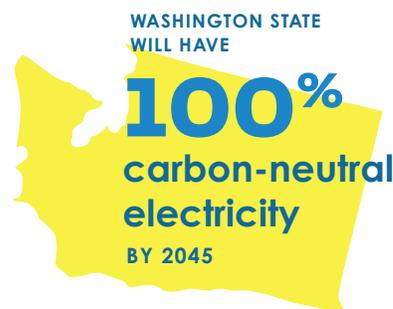
TECHNICAL BRIEF

High Performance CO<sub>2</sub>

# Heat Pump Water Heaters

for multifamily housing

Domestic hot water accounts for the largest portion of a multifamily building's energy use and greenhouse gas emissions. Using affordable and cost-effective technologies like electric heat pump water heaters will maximize energy efficiency, reduce emissions, and meet energy code requirements without compromising service to residents.



SIGNIFICANT OPPORTUNITY

**Improve the efficiency of water heating** through the use of high-performance CO<sub>2</sub> heat pump water heaters (HPWH).



HPWHs ARE PROVEN TO  
**reduce energy**  
USED TO HEAT WATER  
BY UP TO  
**70%**

BENEFITS



### Efficient

Proven to be up to three times more efficient than gas or traditional electric resistance water heaters.



### Affordable

Incremental costs for HPWHs are between \$500-\$1,000 per apartment, and are expected to drop with increased uptake. Utility incentives may be available.



### Futureproof

All-electric technology qualifies for planned energy code requirements.



### Safe

Resilient technology that eliminates the chance of gas leaks or explosions, especially during seismic events.



### Clean

Produces zero direct emissions and uses the most climate-friendly refrigerant (CO<sub>2</sub>) with a Global Warming Potential of 1.

# Technology

HPWHs use electricity to draw heat from the surrounding environment.

Operation of a high performance HPWH is based on the same thermodynamic cycle found in household refrigerators, which involves the circulation of a fluid refrigerant through a loop that successively undergoes expansion, evaporation, compression, and condensation.

High performance CO<sub>2</sub> heat pumps are **3x more efficient** than gas or standard electric water heaters, can produce very hot water (up to 180°F) to mix with cold for optimal comfort, work well in temperatures below zero, and use the most climate-friendly refrigerant.



**3x**  
more  
efficient  
THAN GAS OR  
STANDARD  
ELECTRIC WATER  
HEATERS



**0**  
direct  
emissions

## 3

### typical configurations

- ✓ **Centralized**  
HPWH plant serving whole building
- ✓ **Grouped by stack**  
1-3 residential HPWHs serving multiple units
- ✓ **Individual**  
One HPWH per unit (larger units)

### MAIN CONSIDERATIONS



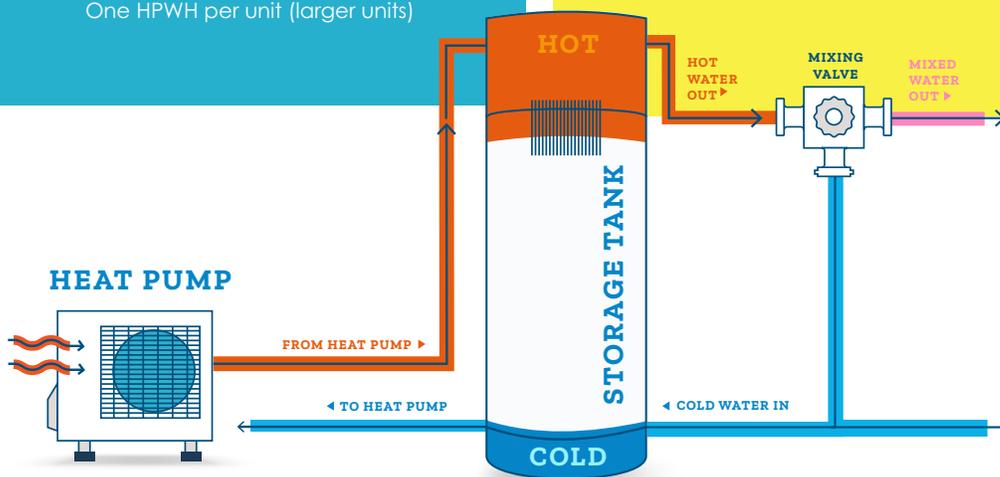
#### location

Because heat is sourced from the surrounding air, CO<sub>2</sub> HPWH compressors can be located outdoors or in a buffered basement or garage.



#### sizing

HPWHs heat water more slowly than natural gas; to ensure meeting peak time-of-use needs, more storage is required.



### Ecosizer

A free tool that supports designers with optimal sizing of centralized heat pump water heater systems for multifamily buildings.

[ecosizer.ecotope.com](https://ecosizer.ecotope.com)

LEARN MORE

Advanced Water Heating Initiative  
[newbuildings.org](https://newbuildings.org)

Exemplary Buildings Program  
[exemplarybuilding.housingconsortium.org](https://exemplarybuilding.housingconsortium.org)