

# Field Study of Cold Climate Air-to-Water Heat Pumps

This three-year field project investigated the air-to-water heat pump market and potential applications for Minnesota homes. Four installations, including both low cost and high performance systems were installed and monitored for up to two heating seasons to evaluate the potential of AWHP systems in cold climate construction.

## Major Findings

1.

**Air-to-water heat pumps (AWHPs) are air source heat pumps!**

Dozens of models and configurations are available for a variety of Minnesota residential applications.

2.

**Like ASHPs, AWHPs primarily function as space heating systems.**

**6,300 to 16,600 kWh/yr savings** for the systems field tested in this study.

Projected heating energy savings for similar applications ranges from **27% to 50%**.

3.

**When not heating or cooling, AWHP systems can also provide domestic hot water service.**

**4,100 kWh/yr savings** for the systems field tested in this study.

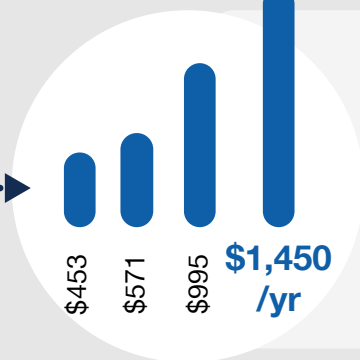
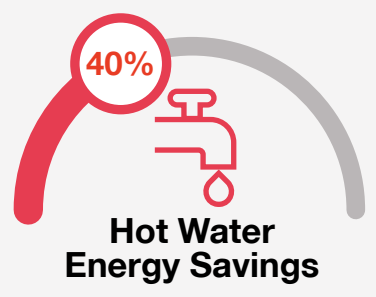
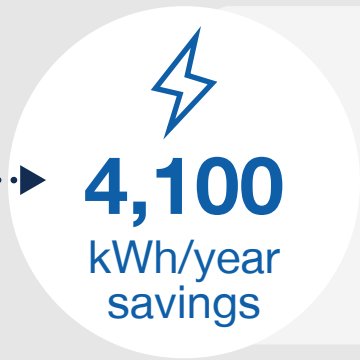
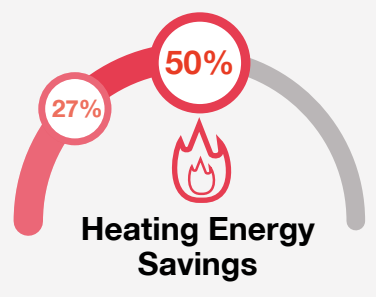
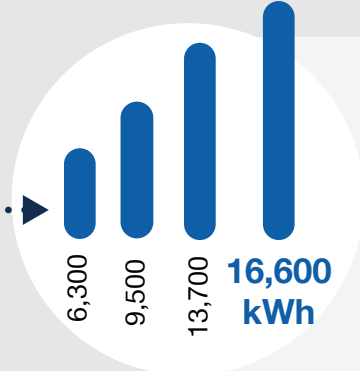
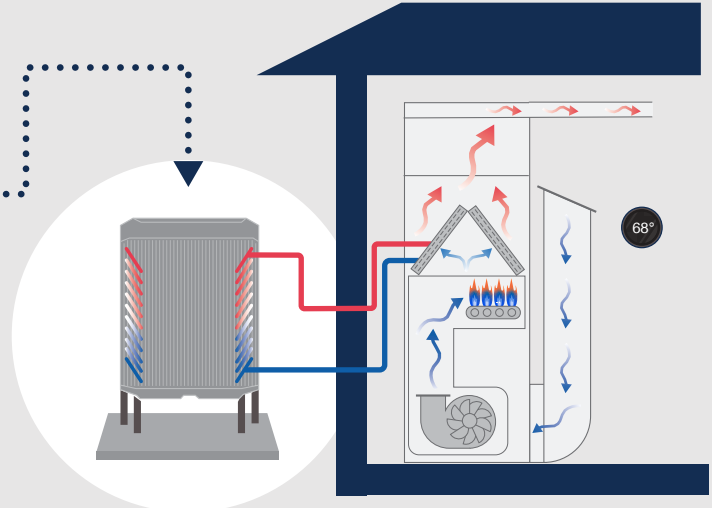
Energy **savings of 40%** compared to the baseline electric resistance unit

4.

**AWHP systems provide compelling overall energy cost savings for customers with electric resistance or propane baselines.**

**\$453 to \$1,450/yr** cost savings per year in this study

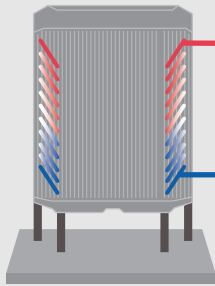
The projected energy cost savings for similar applications ranges from **27% to 53%**



# Barriers

5.

While AWHP systems are compatible with all types of radiators, cast iron and older baseboard units designed for high temperatures (160°F and up) struggle to supply capacity at lower AWHP temperatures.



6.

AWHPs still face significant market barriers including limited workforce experience and lack of standard rating methodologies.

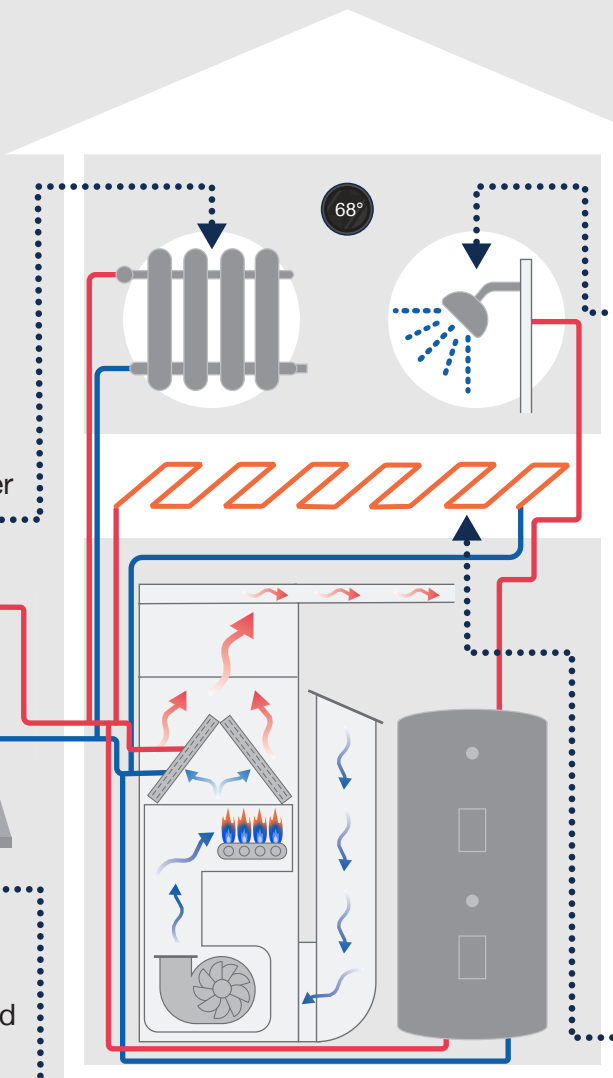
7.

The flexibility of AWHPs to work in many system configurations poses additional complexity and often requires additional design work.

# Opportunities

8.

AWHPs have current opportunities in retrofit or new construction homes that feature low temperature emitters, such as radiant slabs.



# Recommendations

9.

**Treat AWHPs as ASHPs. Align this subset of ASHP technology with existing ECO models and programs. Replicate existing strategies for overcoming ASHP market barriers for AWHPs.**

10.

**Advocate for standardized ratings for AWHP systems. Use established qualified product listings to make AWHP systems compatible with existing ASHP programs, such as the strategy developed by Efficiency Vermont and adopted by MassSAVE and Otter Tail Power.**

11.

**Promote AWHPs as potential customer solutions in any instance where a cold climate ASHP is determined to be beneficial but impractical to implement due to the existing hydronic infrastructure.**