Optimized Installations of ASHPs for Single-Family Homes



This field study developed and validated design, installation, and operational principles necessary for cold climate air source heat pumps (ASHPs) to achieve high market acceptance and maximum energy savings in Minnesota. This project describes the key design and installation principles needed for high-quality ASHP installations that can deliver the efficiency, energy savings, and environmental benefit potential of heat pump technologies.

Best Practices for Design & Installation

1. ASHP design should align with the customer's goal and expectations regarding operating costs, efficiency, and environmental benefit.

   Example: Some owners prioritize low-cost operation, others prioritize emissions reduction, and some may be most interested in comfort. Others may want to balance all benefits. A good system design will align with homeowner preference.

   Reference: ASHP Sizing & Selecting.pdf (neep.org)

2. In retrofit applications, the heat pump type should be determined based on the existing HVAC systems and the home's layout.

   Example: A home with distributed heating sources, such as baseboards, and small rooms would be best met with a ductless heat pump and, if the heating load allows, a multi-head system should be considered.

3. ASHP should be sized by house loads based on measure data or detailed load calculation. The sizing assessment should include considerations for design choices made for each installation. These choices include:

   a. Sizing ductless systems based on the specific zone where the indoor head is installed.

   b. Considering the intended operating conditions of the heat pump, i.e., is it intended to offset heating load at cold outdoor temperatures or only designed to operate in the shoulder heating seasons.

Example: A ductless mini-split to be installed in the main living space of a home and offset as much heating load as possible should be sized based on the design load of the living room zone and the heat pump capacity should be matched to the heating load at design temperature conditions.

Reference: Load Calculations | Air Source Heat Pump Collaborative (mnashp.org)

Benefits of these Principles

Following these design and installation principles will ensure the following.

- Occupant expectations are met.
- Comfort is maintained or improved in the conditioned space.
- Efficiency and energy use expectations are met and benefit the occupants.
- Impacts to the customer's utility bills are balanced and cost benefits are delivered.

Center for Energy and Environment

COMMERCE DEPARTMENT
DIVISION OF ENERGY RESOURCES

This project was supported by a grant from the Minnesota Department of Commerce, Division of Energy Resources through the Conservation Applied Research and Development (CARD) program.