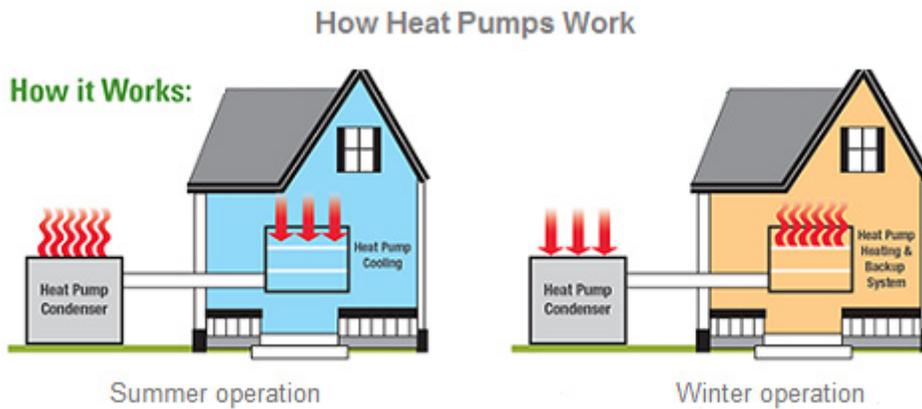


# Reaching City Climate and Energy Goals with the Help of Heat Pumps

## What is a heat pump?

Most homes and businesses are heated by burning fuel in a furnace or boiler and circulating that heat through the building. Heat pumps don't create heat — instead, they move it from one location to another, similar to how a refrigerator works. Heat pumps can cool and heat — all with the same equipment. The latest cold-climate heat pumps can operate efficiently at temperatures as low as -20°F.

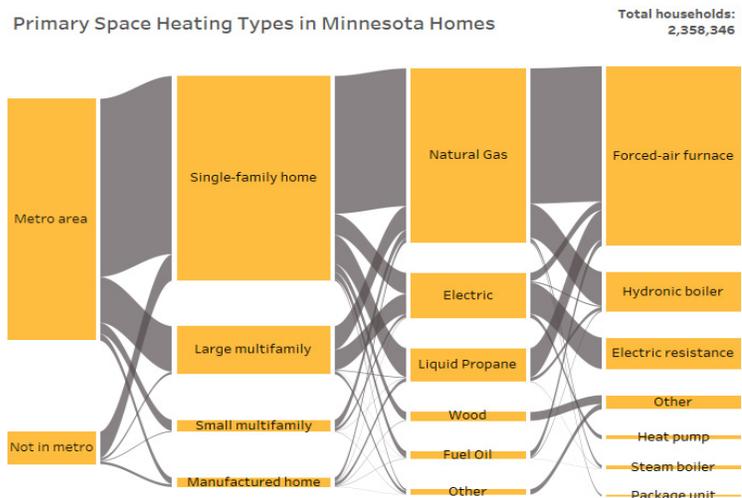


**Heat Pump Operation:** In the summer, heat pumps move heat from the inside to the outside of a home. In the winter, the process is reversed.

## Heat pumps as a carbon-saving strategy

As renewable energy is added to the electric grid, more and more communities are looking for strategies to take advantage of low-carbon electricity. Heat pumps offer customers the ability to save energy and carbon, as well as other benefits such as decreasing reliance on natural gas combustion inside the home. The chart to the right shows the majority of residential heating in Minnesota comes from forced air furnaces powered by natural gas.

Two important factors determine the benefits of heat pumps: (1) how local residents currently heat their homes; and (2) how clean their utility's electric grid is.



## What you should know

When you are thinking about adding a heat pump to a building, there are a number of factors to consider.

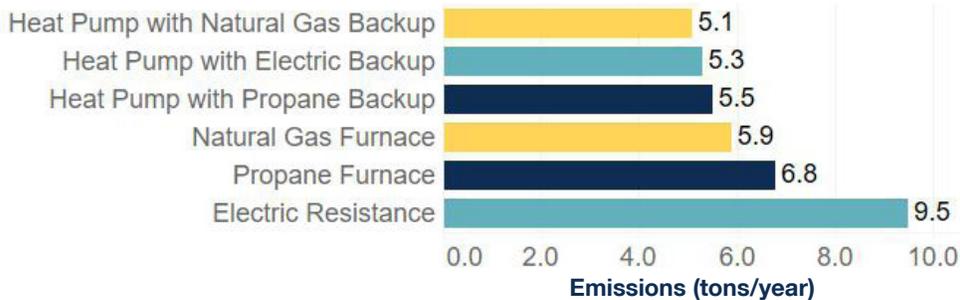
- 1. Building type:** Currently, the technology is most established for residential buildings. Commercial buildings have variable refrigerant flow system options — although, there are fewer case studies of these in cold climates.
- 2. Contractor knowledge:** Heat pump technology is a new but growing area of knowledge for Minnesota contractors.
- 3. Performance:** The ideal heat pump system is optimized for energy performance and cost-effectiveness. The system must be sized appropriately to handle the amount of energy used, which is determined by things like home size, insulation levels, and air tightness. Installation costs vary greatly, from a few thousand to several thousand dollars, depending on the heating load and existing heating system. Assuming current energy rates, an average single-family home can expect annual heating costs below given the following systems.

Average MN home heating costs by heating system*	Natural gas condensing furnace	Electric resistance	Propane condensing furnace	Heat pump**
	\$735	\$1,825	\$1,546	\$1,001

\*Assumes single family home with 30,000 BTU heating load. \*\*Assumes all electric, ducted heat pump system.

- 4. Carbon emissions:** Over the lifetime of the system, heat pumps using today's electric grid mix have lower average carbon emissions, as shown below. Note that the heat pump emissions depend not only on grid emissions, but also on the emissions of the backup system. The modeled emissions from electricity from heat pumps and electric back up systems below are based only on current grid emissions factors and will decrease as the grid becomes cleaner.

**Average Lifetime Annual Equivalent Emissions by Heating System Type**



- 5. Backup system:** Because heat pumps can only provide heat down to -20°F, a backup system with controls to automatically activate it below that temperature is necessary to keep warm in intense Minnesota winters.
- 6. Efficient cooling:** Heat pumps are a good solution for more efficient cooling. When installed as an AC replacement, they can keep spaces conditioned during the shoulder seasons (e.g., fall and spring), which saves energy and carbon.

## How cities can promote heat pumps

Heat pumps provide an opportunity for communities to meet their carbon-reductions and sustainability goals. Cities can leverage their communication channels, update existing processes, and create new policies to promote this new technology. Through this promotion, cities will enhance workforce and economic development opportunities.

### Process updates

- Add heat pumps as a standard option to your building and mechanical permits list.
- Avoid requiring additional permits or permit fees for heat pump installations.
- Share heat pump info sheets during your development review process to advertise them as an innovative, green technology and an opportunity for developers to meet net-zero energy building requirements.
- Leverage planned unit development, land use variances, and other planning tools to promote heat pumps as a preferred sustainable heating and cooling option.

### Policy and incentives

- Reduce the permit fees for installing a heat pump as compared to installation or replacement fees for furnaces, boilers, or AC units.
- Update building and zoning standards to remove natural gas service hookup requirements when a developer chooses to use electric heating and cooling equipment.
- Develop a sustainable building policy or update an existing one to incorporate heat pumps as a preferred heating and cooling source to help meet sustainability goals.
- Create an incentive program, such as a green cost-share program, to promote heat pumps as a sustainable heating and cooling technology.
- Leverage franchise fee revenue to incentivize heat pump installations with a bonus or matching rebate.

### Workforce and economic development opportunities

- Share info sheets with contractors and vendors through existing permitting and contract communication channels.
- Require heat pump training as a condition of joining your city's preferred vendor list.
- Educate city permit, inspection, and planning staff about heat pump technology and key talking points for homeowners, building owners, contractors, and developers.
- Leverage business investment grants (e.g., DEED Minnesota Investment Fund) as an opportunity for businesses to train their staff.

## Additional resources

CEE's Home Energy Hub  
[homeenergyhub.org](https://homeenergyhub.org)

CEE's Heat Pump Cost and Emissions Calculator  
[mncee.shinyapps.io/bene\\_elec/](https://mncee.shinyapps.io/bene_elec/)

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## About Center for Energy and Environment

Center for Energy and Environment (CEE) is a clean energy nonprofit with special expertise in energy efficiency that stretches back nearly 40 years. Working in homes, businesses, and communities, CEE discovers and deploys the most effective energy solutions to strengthen the economy and improve the environment.