

## Heat Pumps are Cool

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By Thomas Beck, AIA, NCARB

There seems to be a lot of misunderstanding about heat pumps. Not only do heat pumps heat, they also cool or provide air-conditioning (AC). They are way more energy efficient than standard electric baseboard or window air-conditioners. To state it simply, they work like a refrigerator, taking heat out of the refrigerator box (house) and making it cool. They can work in reverse, taking outside heat to make the box (or house) warmer. This type of heat pump is an air-to-air heat pump.

Another variety is geothermal heat pumps that use circulated water to transfer the heat. Geothermal heat pumps are even more efficient than air-to-air pumps, but they also cost more so the payback period is slightly longer. If you are going to own a new home for more than 8 years then looking into geothermal is worthwhile. I have designed geothermal heating and cooling systems for several Salud Health Clinic locations. The geothermal systems have saved the non-profit lots of operating capital for their clinics in Fort Morgan and Commerce City, which can be used for funding their mission of providing quality, integrated health care to the communities in which they are located, rather than paying large energy bills. According to Energy Star, Geothermal Heat Pump tax credits are separate from the other incentives and therefore do not count against the annual limit.

Air-to-air heat pumps for houses are done in two basic ways. If you have a ducted system it is similar to a standard gas-fired furnace. The gas burners are replaced by a heat transfer coil using a refrigerant to transfer the heat from inside to out in cooling mode or outside to inside for heating mode. A fan blows air over the coil, which uses the ductwork to distribute the cooler or warmer air inside the house. This type of ducted system works well for a retrofit of an existing ducted furnace system. One major drawback is there is only one thermostat or one temperature zone.

Another version of air-to-air heat pumps still has one condenser outside like a standard AC system but has multiple heat transfer coils inside mounted on a wall or in a ceiling at each location. This allows for multiple thermostats or zones for more control of temperatures in different parts of the building or house. For instance, a cooler bedroom and a warmer kitchen/dining room.

There is now a 30% tax credit of up to \$2000 due to the Inflation Reduction Act which would help reduce the payback period on installing a new heat pump system. For even greater saving consider installing a solar system to provide some of the electricity for running your home heat pump heating system. If your household income is below 150% of local median income you'll receive up to 50% of the heat pumps cost, and below 81% of median income you can receive 100%, up to \$8,000.

The one major caution I have is air to air heat pumps become less efficient when it gets really cold: single digit and below zero cold. I encourage my clients to have some type of backup heat source when it is really cold for several days. Either a woodstove or a small amount of electric baseboard or in-floor heat that you only use in these occasions when necessary. There are also gas wall heaters available that do not use any electricity to operate which are also a good backup option. Having a woodstove or other heat option that works when the power is out is always good. In my previous off-grid home I had a gas wall heater for backup heat. I really only needed it once in ten years but when I came home from a two-week winter vacation the power was off, but the house was still 62 degrees with just that one small wall gas heater. Granted the house was extremely well insulated but it stayed warm.

Biomass stoves and boilers are also eligible for tax credits. "Biomass stoves burn biomass fuel to heat a home or heat water. Biomass fuel includes agricultural crops and trees, wood and wood waste and residues (including wood pellets) ..." These rebates are subject to aggregate annual limits combined with heat pumps and heat pump water heaters, and must have a thermal efficiency rating of at least 75%.

In addition, now there are heat pump water heaters available. They are more expensive than standard electric resistance water heaters but again they are more efficient. Paybacks for the additional

costs depends on your electric rate and how much hot water you use. Typical payback periods are in the 3-to-5-year range. Tax credits and rebates to cover up to 100% of the cost are also available for these heat pump water heaters.

Extensive information about these incentives and rebates can be found at [https://www.energystar.gov/about/federal\\_tax\\_credits](https://www.energystar.gov/about/federal_tax_credits). This link includes a tab for Home Builders and for Commercial Buildings, as well as the Homeowner incentives we discuss in this article.

The easier we make it to adopt energy efficiency the more we will see people choosing to do so, which will be a win-win for our wallets, our communities and our planet.

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