AT HOME WITH A HEAT PUMP **March, 2024**

We installed a heat pump for heating and cooling our Bellingham home. The ducted system is fifteen months old; upstairs already had a mini-split. A heat pumps works like a refrigerator in reverse, using electricity to pump a refrigerant fluid around a circuit to extract heat from the outside and move it inside the house in winter, and in summer to absorb indoor heat to dump outside. Because heat is mostly transferred instead of generated, heat pumps use less energy and are two to four times more efficient than gas furnaces or electric heaters. And most households will cut carbon emissions with a heat pump, especially as renewable electricity sources increase.

Buying a heat pump: There are good guides online; here are a few tips. Consider insulation; homes can leak up to 20% of energy if this is insufficient. Our drafty California house needed this. Look for a reliable HVAC service that is knowledgeable about heat pumps, to calculate the proper size, suggest heat pump options and layouts, and alert you to rebates. Consider backup heating if temperatures regularly fall below freezing. We opted for electric-resistance heat strip backup; others might choose an off-grid wood pellet stove, fossil fuel furnace, or no backup. There are also cold climate heat pumps that provide heat at outdoor temperatures down to -15°F or so. We upgraded the electric panel to accommodate heat pump, induction stove, and EV charger. For us, noise was an issue; keep neighbors and bedrooms in mind when placing the outdoor unit. We added an air purifier to boost indoor air quality. The heat pump does feel a little different; in the winter the indoor air doesn't blow as hot, but is more constant.

Cost: Heat pumps have higher upfront costs, but may save money over time when replacing oil, propane, or electric-resistance heat. The calculation is fuzzier for natural gas and places where electricity is expensive, like California. Actual savings will depend on fuel prices, which fluctuate and vary regionally, as well as the heat pump, house, and local climate. I don't have old utility bills for this house to compare our costs here.

Who uses heat pumps? Heat pumps are in 90% of homes in Japan, and over 40% of households in Norway, Sweden, and Finland, three of Europe's coldest countries. Heat pumps work fine in the cold! In the United States, they provide heat for 16% of households and are mostly found in Southeastern states. Heat pumps outsold gas furnaces for the first time in 2022. Maine surpassed its goal to install over 100,000 new heat pumps, two years early!

Ground-source heat pumps: These heat pumps transfer heat from and to below ground and are even more energy efficient than air-source heat pumps, because underground temperatures are more stable year-round compared to outside air temperatures. The drilling to install closed loop liquid circulation systems is expensive, however. Another variation, ground-source geothermal district heating, loops heat pumps together to heat and cool a network of residential, commercial, or community buildings. Campuses such as Carleton College, Princeton, and Boston University are leading the way in the US on these geoexchange systems.

Is a heat pump for you? It takes a little planning, so if your furnace is getting old or if you might shop for an air conditioner, think ahead about a heat pump. It's the choice that uses less electricity more efficiently with fewer emissions, to provide both heating and cooling. We are happy with our heat pumps!

Resources

Buying a heat pump
> Rewiring America *guide* (https://homes.rewiringamerica.org/projects/heating-and-cooling-homeowner) *and personal electrification planner for going all-electric, explained in this podcast* (https://www.volts.wtf/p/so-you-want-to-electrify-your-home)
> EnergySage (https://www.energysage.com/heat-pumps/) *– I did not use their HVAC referral*
> *Home energy audit, blower door test* (https://www.canarymedia.com/articles/guides-and-how-tos/what-is-a-home-energy-audit-and-why-you-should-probably-get-one)
> *More technical guide* (https://thezeropercentclub.org/cold-climate-heat-pumps/). "*Manual J" is the process of calculating heat load/loss to determine the proper size of the system, based on building characteristics (e.g. sunlight solar gain, air leakage, insulation, construction materials). Avoid undersizing and oversizing. HSPF2 and SEER2 are heating and cooling efficiency ratings. Efficiency and heat output fall as it gets colder; see the manufacturer table of COP (~ overall efficiency) and heat output at different temperatures or look specs up at* (https://ashp.neep.org*).*
> (https://www.canarymedia.com/articles/electrification/yes-its-possible-to-electrify-a-home-on-just-100-amps) *Ways to avoid upgrading the electric panel, such as using a circuit-splitter*
> *What if the power goes out? (*https://www.oasiscooling.com/blog/why-your-gas-furnace-wont-work-when-the-power-goes-out/) *Heat pumps run on electricity, but modern gas furnaces also use electricity, for the ignition, blower fan, and thermostat. Be safe!*
> *Set and forget: Inverter heat pumps run continuously at variable speeds to use only as much energy as needed, unlike conventional furnaces or air conditioners that repeatedly switch on and off. Heat pumps work best if you set a comfortable temperature then leave the thermostat alone.*
> *Low carbon emissions* (https://rmi.org/now-is-the-time-to-go-all-in-on-heat-pumps/)
> *A heat pump story* (https://decarbonizeyourlife.substack.com/p/cold-climate-heat-pumps-toasty-homes?publication_id=1297766&utm_campaign=email-post-title&r=16p001)

Cost
> *You may save money* (https://carbonswitch.com/heat-pump-savings/). *Projected drop in energy bills for a majority of Americans* (https://www.nrel.gov/news/press/2024/benefits-of-heat-pumps-detailed-in-new-nrel-report.html).
> *Rebates: IRA tax credits are available now. IRA rebates at purchase will be set up by states. IRA calculator* (https://www.rewiringamerica.org/app/ira-calculator). *IRS FAQ* (https://www.irs.gov/pub/taxpros/fs-2022-40.pdf); *air-source and ground-source heat pumps are distinct in Form 5695. Check for rebates/guides from state, locality, utility, and manufacturer.*

Who uses heat pumps?
> (https://www.iea.org/commentaries/global-heat-pump-sales-continue-double-digit-growth); (https://www.rewiringamerica.org/pace)
> *Maine* (https://www.washingtonpost.com/climate-environment/2023/02/07/maine-gas-industry-heat-pumps/)

Geoexchange:
> *Examples* (https://yaleclimateconnections.org/2022/08/geothermal-heating-and-cooling-renewable-energys-hidden-gem/). *Videos from HEET* (https://www.heet.org) *and Carleton College* (https://www.carleton.edu/geothermal/)