

Everything you need to know about adding heat pumps to your home



Because of their incredible efficiency and the makeup of our electric grid, heat pumps already produce fewer emissions than oil, gas, or propane heating systems, experts say. *Adobe Stock*

By now, you may have heard about heat pumps. But do you know how these mysterious machines actually work? Or whether they'd make sense for your home?

There's a reason for the hype around heat pumps: They hold the key to electrifying buildings, said Meg Howard, program director at [Massachusetts Clean Energy Center](#), and could dramatically cut statewide greenhouse gas emissions.

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heating systems, Howard said. And as the grid gets greener with every solar array and wind farm that comes online, Howard said, "Heat pumps are only going to get cleaner over the lifetime that you have them, so they're really putting us on a path to eliminate emissions from buildings."

The environmental benefits alone motivate a lot of homeowners, Howard said. But there are plenty of other good reasons to invest in a heat pump, too. "The biggest one that drives a lot of people is an opportunity to add cooling," she said, especially to older homes with radiators or baseboard heating.

Because, despite its name, a heat pump is essentially an air conditioner.

How do heat pumps work?

"A heat pump, simply put, is an air conditioner that works in reverse," said Richard Trethewey, longtime heating and plumbing expert for the home improvement show ["This Old House."](#) "When you have an air-conditioning system, the refrigerant absorbs heat that's in the air and dumps it outside. The heat pump just reverses that process, and it finds the heat outside and delivers it into the building."

Early heat pumps earned a bad reputation because they couldn't keep up in bitterly cold weather. But in the past two decades, Trethewey said, Asian manufacturers made huge advances in cold-climate heat pump technology. Now, as long as there's heat energy present in the air outside — and there's always some, until we reach [absolute zero](#) (negative 273.15 degrees Celsius/negative 459.67 degrees Fahrenheit) — an inverter heat pump can pull heat energy into its refrigerant, pressurize it, and move it indoors. Modern cold-climate [heat pumps have been shown to operate efficiently even at sub-zero temperatures.](#)

The main reason heat pumps are so efficient is that, instead of creating heat, they're simply moving it around. While the highest efficiency gas boilers can generate almost as much heat energy as they consume, as measured in BTUs, an air-source heat pump can deliver up to three times more BTUs than it uses, according to [the US Department of Energy](#).

Different types of heat pumps extract and deliver those BTUs in different ways. Air-source heat pumps, which pull heat energy out of the ambient air, are the most common — the ones you've probably seen mounted outside an office building or neighbor's house. Ground-source or geothermal heat pumps are even more efficient, but also more costly upfront: They require a deep well to be drilled, making them better suited to new construction projects.

How the heat pump delivers warm or cool air into your home will also differ, depending on your heating infrastructure. In homes with forced hot air, a central heat pump can simply replace or augment a furnace by tapping into existing ductwork.

Homes with radiator or baseboard heating, meanwhile, can make use of a ductless mini-split heat pump. "It's like you took a chainsaw and cut a window air conditioner in half," Trethewey said, putting the noisy condenser part outside, the quiet blower part inside, and connecting the two with a pair of refrigerant lines. One external condenser unit can supply heating and cooling to a single indoor head, or to multiple consoles with their own controls, making it possible to create different zones throughout a home.

Some newer systems, Trethewey said, can even operate in different modes at the same time: cooling a sunny south-facing room, for example, and transferring that excess warmth to a unit on the colder, north-facing side of a house.

How much do they cost?

In 2018 and 2019, [the average cost of a single-head residential heat pump](#) installed in Suffolk County, which includes Boston, was \$6,474, according to MassCEC data. Installation prices have almost certainly risen since then, though, and whole-home systems cost more. In [a 2020 MassCEC pilot program](#), the median cost of installing a whole-home heat pump system was \$18,400 — less for new construction and gut rehabs, more for retrofits of existing buildings.

Some of those costs can be recouped through lower energy bills. “Homes that heat with oil, propane, and [electric resistance](#) typically see their costs stay similar — or usually go down — if they switch to heat pumps, based on current prices,” Howard said. At present rates, that’s less true for natural gas customers, she added — though the US Department of Energy projects [gas heating bills will jump 30 percent this winter](#). Heat pumps are also a smart investment for homeowners with solar panels because they’re using free or discounted electricity.

The cost of installation is a roadblock for many homeowners, said Bill Stack, energy efficiency expert at Eversource — which, along with National Grid and other utility companies, funds and operates the Mass Save program to encourage home-efficiency improvements. But with a Heat Loan through [Mass Save](#), Stack said, “people can borrow up to \$25,000 at 0 percent interest to cover the cost of the installation.”

Mass Save also offers rebates on heat pump equipment purchases, ranging from \$250 to \$1,250 per ton of heating capacity. (Customers in municipal lighting districts typically aren’t eligible for Mass Save incentives — but some communities, including Hull, Marblehead, and Peabody, offer rebates through [MuniHELPS.org](#).) Mass Save’s heat pump rebates currently favor

homeowners who heat with oil, propane, or electric resistance, but natural gas customers are expected to be eligible for juicier offers in 2022.

Utilities and state officials in October were finalizing a new three-year plan for Mass Save that will determine rebate structures and financial incentives for 2022 through 2024. "Rebate levels are going to be enhanced significantly for heat pumps. That's what we are proposing for the next go-round," Stack said. "It's still being negotiated, but we know that, for sure, the emphasis on heat pumps and the incentive dollars and rebate dollars are going to be enhanced greatly."

Making the switch

Before installing a heat pump or mini-split system, make sure your home is properly insulated and air sealed. "There's no sense upgrading to this high-efficiency equipment if your house is leaking like a sieve," Stack said. Mass Save will cover 75 percent or more of the cost for most insulation and weatherization work.

Like any home improvement, it's best done in conjunction with a larger renovation project, so you can take advantage of open walls to hide the refrigerant lines and electric wiring, or even install new ductwork. But it's simple enough to install a mini-split as a one-off project in almost any building. "In a retrofit, you might be forced to put the high sidewall units on the outside wall, and then run the line sets outside the building and make them look like downspouts on gutters," Trethewey said. "It's visually unappealing to me, but sometimes it's the only way you can do it in a renovation where you're not ripping the house apart."

Lynnfield homeowner Alex Jovanovic has had several heat pumps installed since he and his wife, Nada, bought their 1982 oil-heated Colonial. It began

as an experiment, Jovanovic said, when they were looking for a good, cost-effective solution to heat a basement playroom for their kids and settled on a Mitsubishi Hyper Heat mini-split. "In that first year, I ran it on the coldest nights possible to see, like, is it still going to heat? Is it going to heat well?"

It did, so when the family converted a portion of their home into a guest suite for Jovanovic's in-laws, they installed a second mini-split system to heat the space. "We do still run the oil heat on the coldest days but really more as an emergency backup," Jovanovic said.

Finally, when the family's central air unit died, they decided to replace it with a 60,000-BTU Bosch central heat pump. The outdoor condenser connected to a distributor in the attic, which tapped into the existing ductwork to provide both central cooling and heat. "It actually works really well," Jovanovic said, though he later realized the air conditioning ducts are probably undersized for heating. So an Ecobee smart thermostat switches to their relatively new Buderus oil boiler when it gets below 35 degrees outside. "We cut the oil usage in half last winter by using the heat pumps, which is a priority of mine — I want to get off of the oil completely."

Howard said retrofitting a home so it's heated entirely by heat pumps is now far more feasible, as proven by MassCEC's recent pilot program. Some participants left their old fossil-fuel heating systems in place, just in case — but later decided they no longer needed the legacy equipment. And 95 percent were happy with the heating comfort of their whole-home systems. "Even a few years ago, there was a lot of trepidation about whole-home heat pumps in retrofit situations," Howard said. "The big lesson of the pilot for us was, yes, these can be done. Even in older homes, you can retrofit them with heat pumps and eliminate fossil fuels from home heating."

Overall, Jovanovic is "super pleased" with the heat pumps, but he offers one

note of caution. The biggest outdoor condenser can get loud, like a central air unit running full blast in summer. Their old air conditioner had sat next to the garage, but in a bid to shorten the hose connections and improve efficiency, they installed the 5-ton heat pump in a different location — beneath their bedroom window. “We can definitely hear it, especially in the evenings,” he said.

User tips

Aside from cleaning the filters regularly, heat pumps don’t require a whole lot of maintenance, Trethewey said. “The hardest part is getting them installed correctly initially, making sure that the installer puts in the right amount of refrigerant, the right-size unit. But once they’re in and running, they’re pretty bulletproof,” he said. As with a central air conditioner, it’s worth getting older systems checked out periodically.

And contrary to frugal instincts, experts said it’s not worth turning a heat pump’s thermostat way down at night. “The thing with heat pumps is they’re sort of happier if they’re in cruise control,” Howard said, “and a little bit less efficient when they’re trying to quickly heat up a space from a big setback.” Just pick a temperature that feels comfortable, she said, then set it and forget it. If you prefer a cooler temperature for sleeping, program the heat pump’s temperature to gradually drop at night and slowly warm back up in the morning.

“There’s not much downside that I can think of,” Trethewey said. “Except it’s more money upfront, like everything. Funny how that is.”

Jon Gorey blogs about homes at HouseandHammer.com. Send comments to jongorey@gmail.com. Follow him on Twitter at [@jongorey](https://twitter.com/jongorey). Subscribe to our free real estate newsletter at

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