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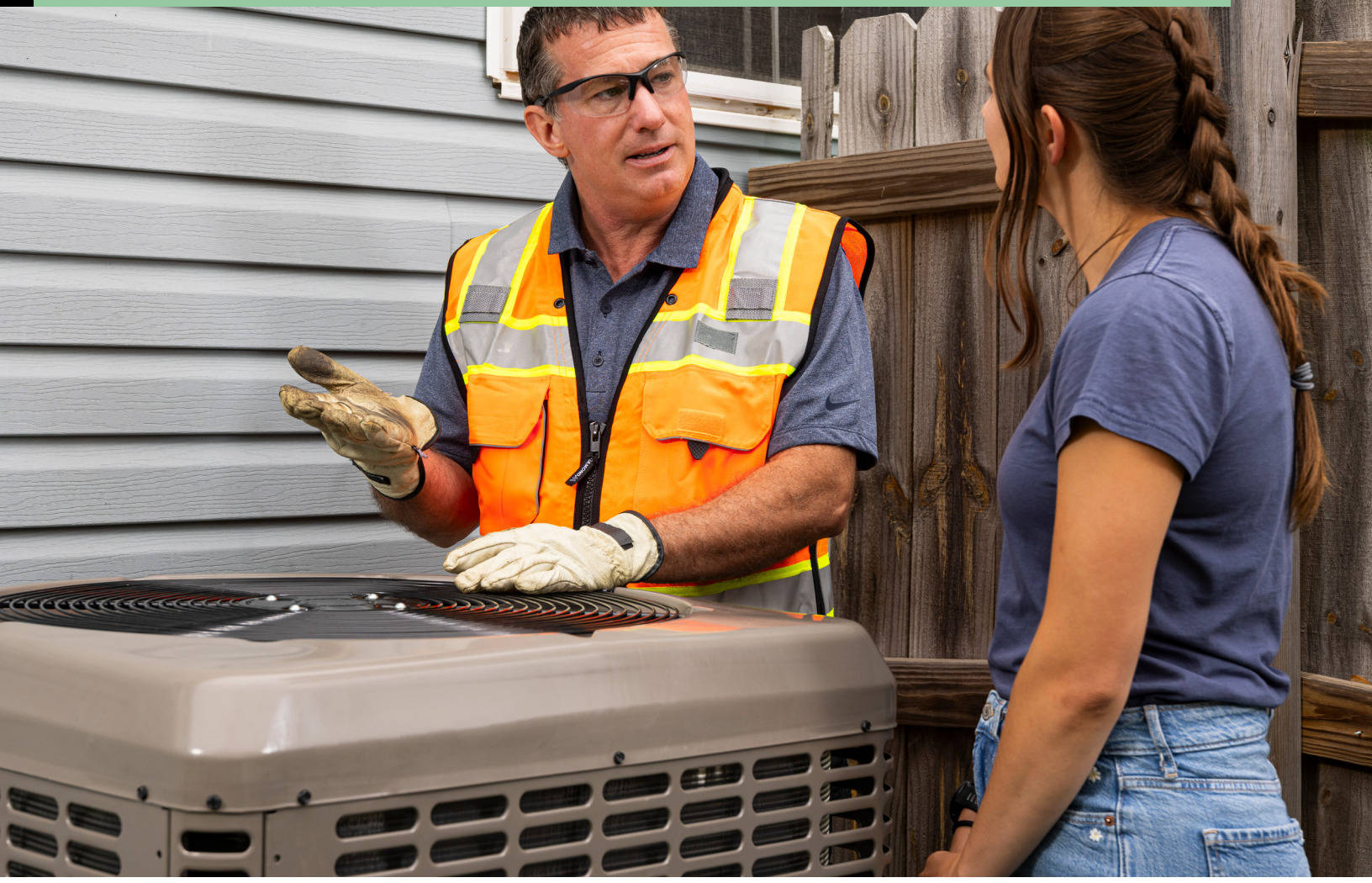
Bringing the heat and balancing the heat pump equation

Evaluating the economic, comfort and regional considerations when specifying residential heat pumps



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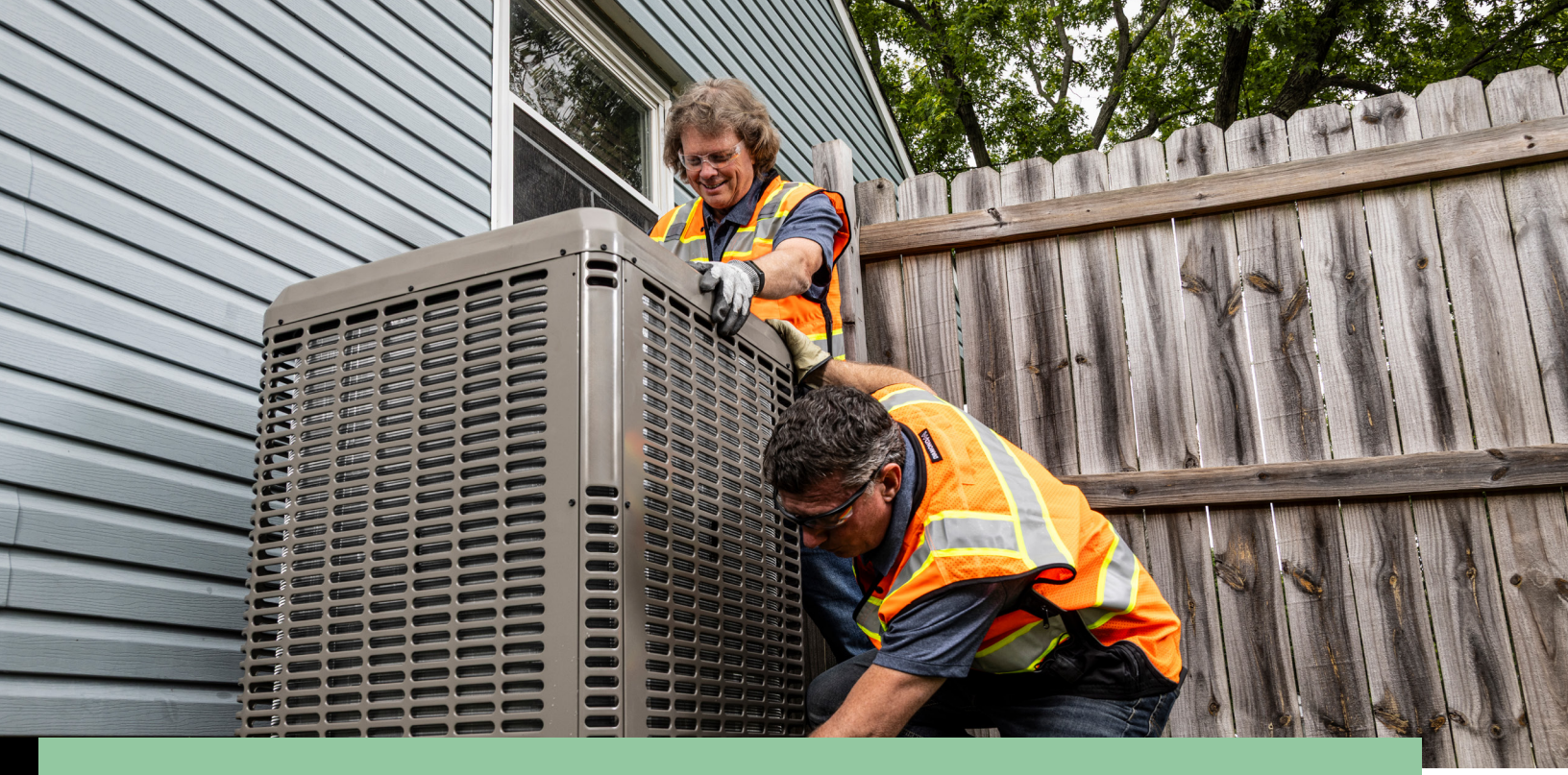

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Residential heat pumps are riding a wave of increased popularity. Recent U.S. consumer data shows that air-source heat pumps outsold traditional gas furnaces by 21 percent in 2023 and 32 percent in 2024, while globally becoming the most common home heating solution.

What's driving heat pump growth? The promise of increased efficiency for starters. Heat pumps provide an all-in-one home cooling and heating solution that is typically three to four times more efficient than gas-powered systems. For many, the potential for consistent energy savings holds the promise of an attractive return on their HVAC investment.

Incentives, including federal and state programs and rebates from utilities and manufacturers, may also fuel this demand. Under the Energy Efficient Home Energy Credit program, homeowners can earn up to $2,000 in IRS tax credits, leveraging available funds through Section 25C of the Inflation Reduction Act (IRA).

Qualifying heat pumps must meet the Consortium for Energy Efficiency's (CEE) efficiency tiers for North American regions. It is unclear if, or how long, these incentives will remain under the Trump administration.

For contractors, residential heat pump technologies have advanced to the point where they can confidently stand behind them. A correctly specified, installed and maintained heat pump can offer years of efficient, reliable service.

One key caveat is that residential heat pumps are not intended to be one-size-fits-all solutions. Options have expanded to address various economic, regional, and comfort requirements.

Contractors must be prepared to guide homeowners through the options and select a system that aligns with their regional heating capacity requirements and individual preferences for comfort and cost.

Overview of heat pump systems

Standard air-source heat pumps (**ASHPs**) are the most common or widely adopted heat pump system technology. They are ideal for moderate climates with low heating requirements. Available in different efficiency tiers (i.e., low, mid, and high), ASHPs provide year-round comfort cooling and heating.

Dual-fuel heat pumps have emerged as a best-of-both-worlds option. They're instrumental in northern regions with cold climates where a standard heat pump may not be able to maintain comfort levels in lower ambient temperatures. Dual-fuel options combine an electric heat pump and a backup heat source, such as a conventional gas-powered furnace or boiler.

In this configuration, a heat pump provides year-round heating and cooling. If the ambient temperature drops and it can no longer produce the capacity needed to maintain comfort, the backup heat source is activated to support the heating load and deliver the expected comfort levels.

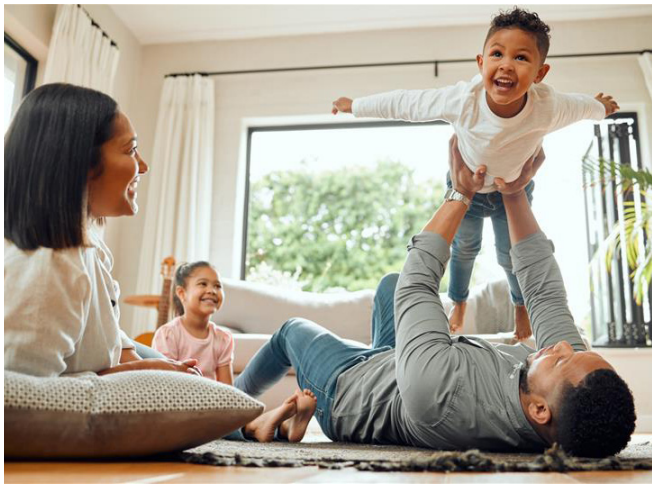
Premium-tier heat pumps are designed to provide highly efficient, cold-weather heating capacities to reduce—and potentially eliminate—reliance on a backup heat source. They're ideal for consumers seeking an electric, robust heat pump solution or meeting anticipated energy efficiency targets. These systems offer premium efficiency, higher capacity and robust performance, enabling end users to maintain comfort longer in frigid climates while reserving the backup heat for only the coldest ambient conditions.

How dual-fuel optimizes comfort, cost and emissions

Dual-fuel heat pumps are viewed as an interim step in the transition from gas- to electric-powered heating solutions. As an industry leader in the research and development (R&D) of HVAC technologies, Copeland has evaluated the comfort and carbon emissions impacts of using dual-fuel heat pumps on the path to electrification.

Research from The Helix Innovation Center found that dual-fuel heat pump systems solve comfort limitations in low-ambient conditions while lowering greenhouse gas (GHG) emissions in many instances. By evaluating local energy rates and the makeup of renewable energy sources of the regional grid, contractors and homeowners can determine the impacts on GHG emissions and energy costs.

For example, an all-electric heat pump may be more expensive to operate than a gas furnace in some regions, while resulting in higher GHG emissions. Compared to an all-electric heat pump or an all-gas furnace system, dual-fuel options were shown to improve GHG emissions, lifecycle costs and comfort in many instances.



Best-fit compression technologies for today and tomorrow

Copeland has developed a wide range of compression technologies to meet the comfort and efficiency demands of current and future generations of heat pumps. We also optimized these to use lower-global warming potential (GWP) A2L refrigerants to comply with the EPA's hydrofluorocarbon (HFC) phasedown.

Fixed-speed Copeland scroll options (e.g., YAK1/YPK1) are designed to provide year-round comfort cooling and heating via standard, base-tier heat pumps in moderate climates. For contractors, fixed-speed technology represents a familiar technological footprint and affordable comfort, while delivering legendary reliability and operational peace of mind.

Two-stage Copeland scroll compressors (e.g., YAS/YPS) offer two levels of compressor capacities by mechanically modulating between 67 percent capacity for low-load conditions and 100 percent capacity for peak-load conditions. Two modulation stages support more precise capacity matching, translating into improved temperature and humidity control and energy efficiency. This technology is well-suited for standard and dual-fuel heat pump systems, where compressor modulation helps to extend the heat pump's comfort range.

- Improves seasonal energy efficiency when only part-load cooling or heating is needed
- Supports enhanced comfort via incremental temperature and humidity control
- Provides effective comfort heating until the heat pump requires backup assistance in colder climates
- Delivers affordable comfort for homeowners

For contractors, two-stage offers the familiar technological footprint of Copeland scroll compression, providing efficiency gains without added system complexities. Mechanical modulation relies on the opening and closing of ports, enabling a portion of the gas to bypass the scroll compression cycle and create the two capacity stages.

Variable-speed Copeland scroll compressor technology (e.g., YAV) further extends the comfort, capacity and efficiency of dual-fuel heat pumps. Based on a highly efficient brushless permanent magnet (BPM) motor and optimized inverter drive, the YAV modulates capacity from 15 to 116 rotations per second (RPS) to precisely match the heat pump's capacity to the home's load.

In part-load conditions, it slows to support lower capacity requirements, avoiding costly stops and starts. When low-ambient conditions call for more capacity to maintain comfort levels, the compressor overspeeds to provide additional heating capacity. This wide speed range helps heat pumps achieve significantly higher heating seasonal performance factor (HSPF2) ratings.

The results are increased year-round efficiencies in part-load conditions, tighter temperature and humidity control for enhanced comfort, and the ability to deliver higher capacities when needed, potentially reducing the need for backup heat.

Variable-speed scroll compressors with enhanced vapor injection (EVI) technology (e.g., Copeland YAW) are designed to support maximum heat pump capacity and efficiency. This robust technology enables the heat pump to overspeed the compressor and inject sub-cooled vapor into the scroll pocket during the compression cycle to expand the upper limits of capacity and efficiency ranges.

In cold climates, the Copeland YAW compressor can increase heating capacity up to 25 percent and heating efficiency up to 10 percent. Its 8:1 speed ratio supports speeds from 15 to 116 RPS, overspeeding during the coldest winter days while slowing down the compressor during moderate seasonal conditions. As a result, it delivers best-in-class HSPF2 and SEER2 ratings while maximizing homeowner comfort in all seasons.

In some cold climate conditions, variable-speed scroll compression with EVI represents the potential for full-furnace replacement in a standard ASHP. Caveat for contractors: As a newer compression technology, you may need to familiarize yourself with EVI-equipped systems.

Conclusion: Apply technologies tailored for homeowner considerations

For contractors, making heat pump recommendations to homeowners requires an understanding of system types, compression technologies and regional considerations. This means evaluating a variety of factors that impact selection criteria:

- Weighing cost and/or affordability concerns, including local energy rates
- Selecting a heat pump type and tier that's best suited for the local climate
- Matching compression technologies to meet design conditions
- Taking advantage of federal and/or regional energy incentives

To meet these varied demands, design conditions and consumer preferences, Copeland has developed a broad range of compression technologies. From fixed-speed, two-stage, variable-speed and EVI, we support best-fit technologies across the ever-expanding residential heat pump landscape.

To learn more, visit **copeland.com**

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