



Heat Pumps Helping to Decarbonize the Residential Buildings Sector



Learn why electrification is a key factor in improving the industry.

Over the past decade, buildings have become more energy-efficient, heat pump performance has improved, and the electric grid has become greener. These actions have led to significant reductions in emissions from building electricity consumption. However, over the same time, building emissions from burning natural gas, fuel oil and propane have remained relatively flat.

To achieve deep decarbonization, buildings must address both electrical and direct fossil fuel combustion. Using intelligent building equipment is the first step in increasing energy efficiency and digitalization. This is critical for the transition to a decarbonized, smart electric grid.

2019 were comparable with those in 2018, with approximately 33 billion metric tons emitted worldwide. However, during that same period, the world economy expanded by nearly 3%. While the fossil fuel emissions appear to be flat, they represent more of a stoppage that could lead to a decrease in GHG in coming years.

In 2019, the United States recorded the largest emissions decline by country, falling 140 million tons, or 2.9%, according to the IEA report. Attributed to this decline is the expanding role of renewable energy (wind and solar), switching from coal to natural gas and the rise in nuclear power generation.

In 2020, the COVID-19 pandemic skewed these figures across the globe, including the United States, with an overall reduction in GHG emissions. It will be important to monitor what happens in 2021 as the economy rebounds and the impacts of both decarbonization and electrification on the market.

FOLLOWING ARE SOME INTERVIEW QUESTIONS posed to Bryan Rocky, Director of Residential Technical Services at Johnson Controls, about these advancements in heat pump technology, including details about how this shift is helping to decarbonize the buildings industry and how contractors can approach homeowners to discuss the benefits of heat pumps.

Q: *Why have emissions from fossil fuels remained flat despite the move toward HVAC electrification?*

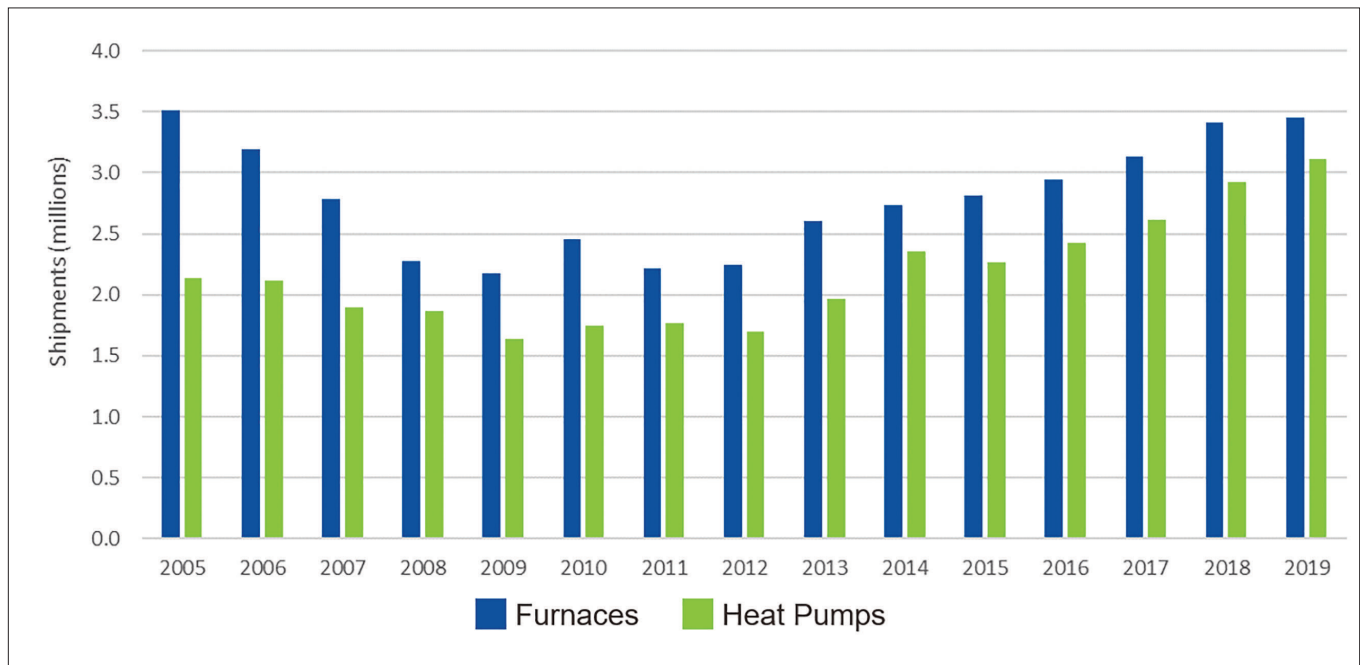
A: When we discuss greenhouse gas (GHG) emissions, it is important to take into consideration the growth of the world economy. The International Energy Agency (IEA) reported in the document titled “Global CO₂ Emissions in 2019,” that global emissions of carbon dioxide in

Q: *What does it mean to say the electric grid has become greener?*

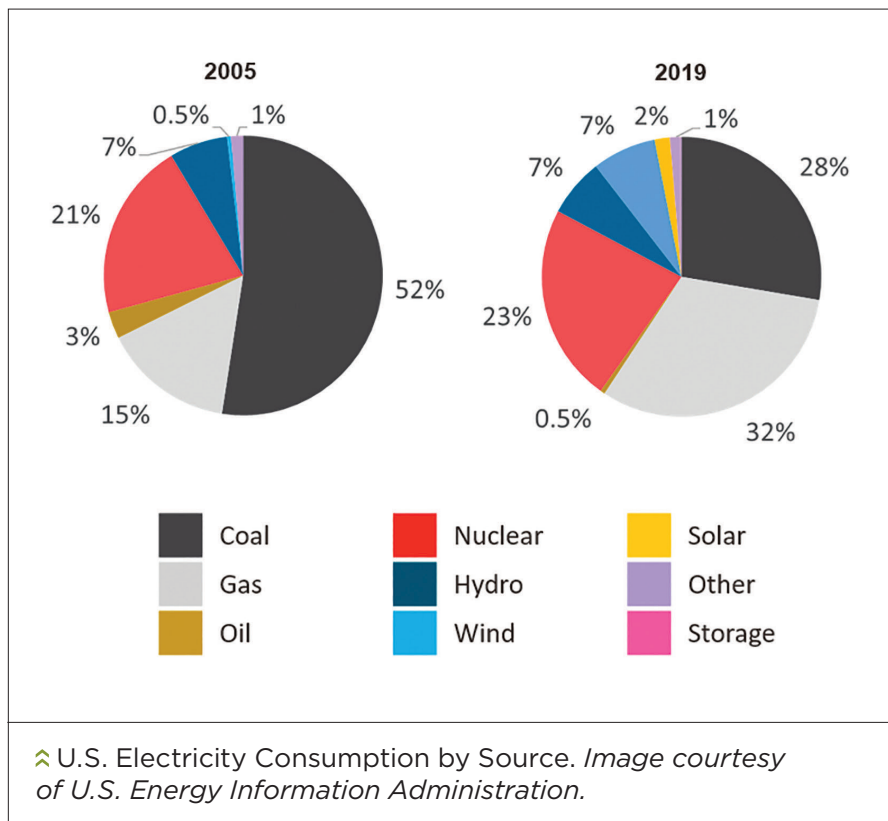
A: America’s electric grid, which provides power from electric sources to the end user, is becoming greener as new, cleaner energy resources are made available. Since 2005, CO₂ emissions from electricity generation is down 33%, despite increases in overall electricity generation in the United States. Buildings consume up to 75% of the electricity that’s generated, and the electricity they do consume is becoming cleaner and less carbon intensive.



HEAT PUMPS



U.S. Furnace & Heat Pump Market. Image courtesy of AHRI.



U.S. Electricity Consumption by Source. Image courtesy of U.S. Energy Information Administration.

The U.S. Energy Information Administration (EIA) released a report in 2020, showing energy consumption for renewables had increased to 11%, compared to less than 1% in 2005. In fact, they project that renewable energy will be the most used energy source by 2050, which will greatly contribute to decarbonization and a cleaner grid. This cleaner grid, paired with the improved energy efficiency of buildings and equipment and electrification of HVAC systems, is contributing to the overall decarbonization of the building sector.

Q: What is driving the shift to electrification and growth in the heat pump market?

A: Growing consumer interest in efficient, environmentally sustainable equipment, utility incentives and advancements in cold weather heat pumps are all contributing to an upward trajectory of residential heat pump sales. In fact, AHRI reported that air-source heat pumps hit an all-time high in 2019, with more than 3.1 million units sold.

Historically, heat pumps have been a staple in southern regions, where cooling is the primary need. However, northern regions are now becoming a major market force, with increased demand for cold weather heat pumps able to efficiently operate in negative temperatures, especially where fossil fuels are either not available or have limited availability. These products are a cost-effective solution to improve home comfort while offering cost and energy savings—even in extremely cold regions, such as the upper Northeast and Midwest.

In addition, several U.S. regional energy efficiency organizations are promoting heat pumps in colder climates, while many states are driving policies that offer aggressive incentives for cold climate heat pumps. For example, Maine recently released a 2020 Climate Action plan that aims to have heat pumps installed in 48% of the housing market by 2030, and several other states are following suit with similar decarbonization or GHG reduction plans.

California in particular has set quite ambitious greenhouse gas emissions reduction goals. From 2000 to 2016, emissions from fuel combustion in the state's residential buildings decreased by 18%, and the state is aiming to continue this trajectory by reaching 40% below 1990 levels by 2030 and 80% by 2050.

Q: *How do you approach the sale of a heat pump to a contractor or technician?*

A: Like all markets, consumers and customers want the same things—choices that meet their own circumstances and are affordable. For contractors and technicians, that may focus on ease of installation, commissioning, and serviceability. But for homeowners, their focus may be energy efficiency, reliability, comfort, communications and/or control options and, as always, an acceptable price.

A contractor must know what is important to the customer and offer options that best meet their needs. Specific to selling

heat pumps, educating the entire channel is important, including distributors, contractors, and homeowners. There have been major developments and improvements in the engineering and design of heat pumps that have greatly improved reliability and performance and made installation and servicing of the equipment easier.

items like CA Title 24 affect how these systems are specified and installed?

A: As the industry continues to develop new products, the increased use of multiple stage, variable capacity, inverter-driven heat pumps will continue. In addition to providing better efficiency, these products offer the superior comfort, humidity

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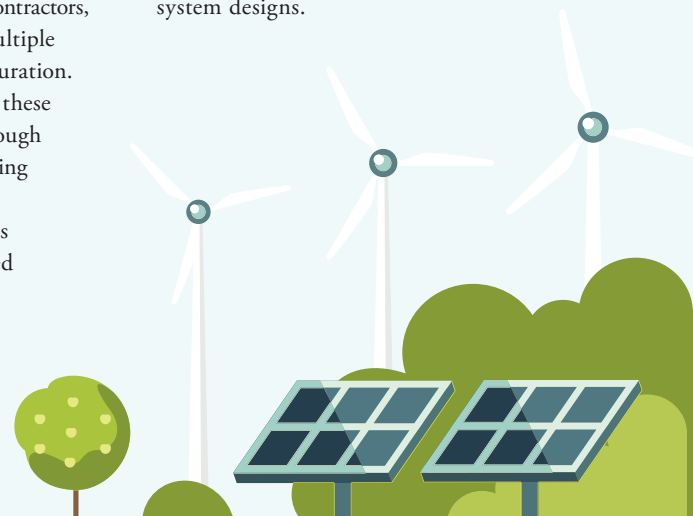
One such technology that is growing in popularity for temperate climates are modulating horizontal discharge heat pumps. Unlike the common vertical heat pumps, which discharge air on top of the unit, these compact systems discharge air horizontally away from the structure, allowing the system to be more compact and fit in a smaller footprint. This makes the systems ideal for zero-lot-line housing, and high-density areas. From the homeowner perspective, they are a great value and more efficient model for the price of a base-tier vertical heat pump. For contractors, installation is simplified with multiple options for placement and configuration.

Informing channel partners of these advancements in heat pumps through training sessions, webinars, marketing collateral, etc., improves their understanding of these new systems and gives them the tools they need to explain these benefits to homeowners.

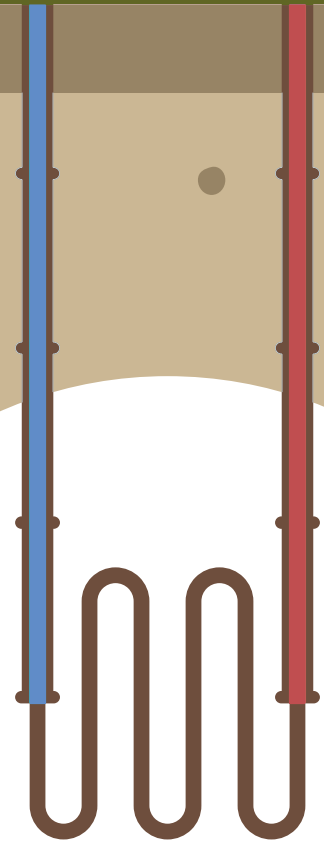
Q: *Are there any advances coming in terms of residential heat pump use? If so, will*

control and connectivity that consumers want. Advanced connectivity provides remote access, demand-response capabilities, and better communication for the consumer when service is needed on their systems. The use of alternate refrigerants to reduce GHG impacts are coming within the next few years as well, focused around 2025 at this time.

This regulatory change requires certain equipment design and control changes, so manufacturers will have the opportunity to include additional enhancement to heat pump system designs.



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Q: How do the controls play a part in “greening” the system? What are important considerations on this side of a job?

A: The Internet of Things (IoT) is allowing for the creation of smarter controls, such as smart thermostats that offer scheduling, motion sensing and geofencing, to allow your system to operate more efficiently, saving homeowners money and reducing energy usage. In addition, as companies transition fossil fuel load to electric end uses, controls will be the key to unlocking deeper decarbonization in the building sector.

The industry is making continued advancements to controls to make them smarter, easier to use and aid in improved system performance. One such example is control algorithms for location-based performance that will optimize systems based on the climate and ambient conditions to help improve heat pump performance.

Q: Are there ways to implement newer technologies into existing systems? If that is possible, what are things to consider when retrofitting?

A: Within the residential market, the primary reason customers look to retrofit an

existing system is to make them more efficient and lower energy costs. There are two main areas where new technologies can be integrated into an existing system. First, a heat recovery ventilator can help recover up to 70% of the heat that escapes through a home’s ventilation system, reducing the energy required to bring outside air up to ambient room temperature.

Another popular choice for homeowners is to install a zoning system in their home, consisting of thermostats, a control panel and zone dampers, which can save homeowners up to 40% on their annual energy consumption. This technology is particularly beneficial for the many Americans working from home, where multiple members of the household may prefer different daytime temperatures within various zones of the home.

CONCLUSION

Combating climate change is a complex undertaking. However, one thing is clear: electrification is the key to decarbonizing the buildings industry, which is a major contributor to GHG production. States across the United States, along with other countries will continue to set regulations

to limit the burning of harmful fossil fuels, clean our electric grid and ultimately make the planet more sustainable. Electric heat pumps are a versatile option for many applications and the key to cutting down on harmful GHG production. They offer homeowners an efficient, high-performing heating and cooling system, while giving contractors greater ease of installation and serviceability that have come a long way in terms of innovation compared to heat pumps of the past. ■

Bryan Rocky is the Director, Residential Technical Services, for Johnson Controls. He is an HVAC industry veteran, with more than 41 years of experience at commercial/residential HVAC original equipment manufacturers (Lennox, Trane, Carrier, YORK and Johnson Controls) in design engineering, manufacturing, product management and technical services areas. He has been an ASHRAE member since 1984 part of several committees and standards groups. Rocky has also been involved with regulatory issues (DOE, EPA, Energy Star, NRCAN, C.E.C. etc.) and industry trade associations (GAMA, ARI, AHRI and HRAI) over the past 30 years in various roles.