The Evolution of Hybrid Heating Systems

George R. Carey, Jr.
VP, Fluid Industrial Associates
gcarey@fiainc.com
twitter: @Ask_GCarey

As the push for "electrification" continues in nearly all aspects of our lives (electric cars, stoves and heating/cooling systems), there should be a discussion on how to incorporate the (relatively) new technology with the existing technology—especially when it comes to heating homes in the Northeast. What do I mean by "new" technology? Utility companies have been pushing consumers to upgrade heating and cooling systems to heat pumps, typically by offering enticing rebate or incentive programs for customers to make the switch to the all-electric (or at least partial electric) heating and cooling system.

Heat pumps have been around for a long time. Historically they would have been listed in three categories:

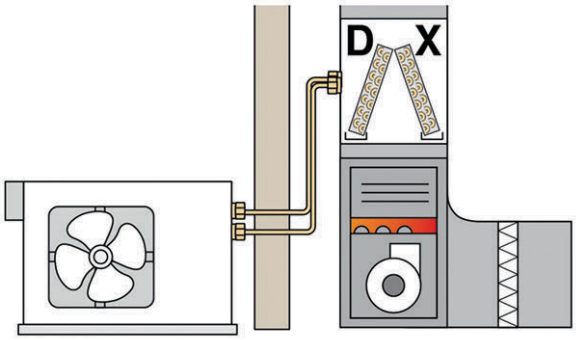
- Air to Air Heat Pumps
- Water to Air Heat Pumps
- Water to Water Heat Pumps

Recently though, a fourth category has been gaining market share: *the Air to Water heat pump*. Similar to the Air to Air style, it takes heat from the ambient outdoor air. Instead of heating air, Air to Water heat pumps use a refrigerant-to-water-heat exchanger to heat the system water, which is then circulated through the closed-loop hydronic system.

Utility companies have made the Air Source Heat Pump (ASHP) technology their primary choice of heat pump technology available. Using air instead of geothermal energy eliminates the expenses associated with drilling a well field and installing the tubing (anywhere from $10,000–$30,000), consuming the necessary footprint to support the well field *and* the operating costs of pumping the well all year long. The air is, well, already there… right in your backyard surrounding the heat pump. This allows for a cleaner, less expensive installation for both the contractor and the homeowner.

However, like so many things in life, there is a trade-off when using air source heat pumps vs. geothermal heat pumps (which have more expensive upfront costs), especially during the heating season. In the colder, northern climates such as New England, New York and Pennsylvania, as the temperature drops, the ability of the refrigerant to extract heat from the air is reduced. The heating system's capacity, as well as efficiency, decreases as it gets colder outside. Most of the current ASHP manufacturers offer "cold-climate" heat pumps that can certainly operate in colder outdoor temperatures than before, but their BTU output and COP (Coefficient of Performance) are still reduced compared their rated capacities at 47°F. This is where a hybrid system comes in.

When a customer wants to install an air source heat pump into an existing home because of utility rebates or reducing their carbon footprint, instead of throwing away the older heating system (such as a warm air furnace or hot water boiler), they should keep the "legacy" heating system. The



- Heat pump systems with a back up furnace or hydronic fan coil are known as a Dual Fuel system
- Heat pump is shut off whenever the backup heat is on.
- This prevents the back up heat from heating the refrigerant and locking out the heat pump compressor.

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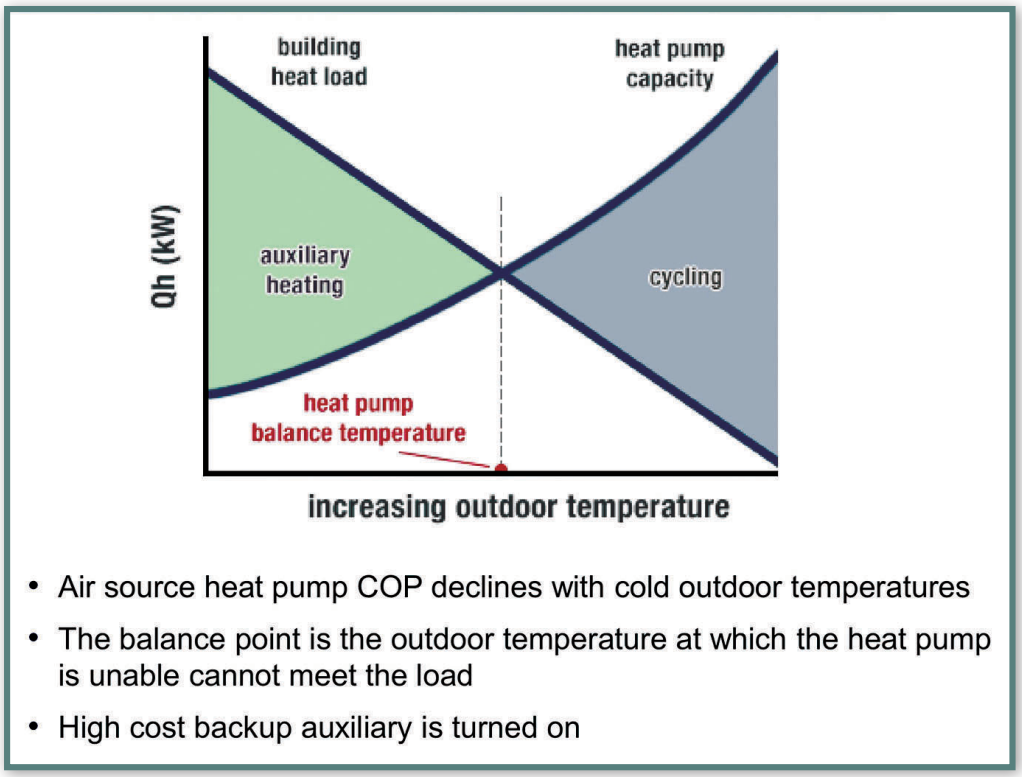
customer can operate their new ASHP system for the summer months in the Cooling Mode, which will keep the house comfortable. When the Fall arrives and outdoor temperatures drop, they can run the heat pump in the heating mode and it will operate very efficiently. Even though the air temperatures feel cold, the refrigerant is able to extract heat from the air very efficiently with *variable speed compressors* that adjust its output based upon the load conditions. As the temperatures outside become extremely cold, the customer can disable the heat pump system (which is starting to operate inefficiently) and have their legacy heating system (boiler or furnace) turn on and keep the house comfortable. When the extremely cold temperatures dissipate, the legacy system can be turned off and the ASHP system will come back on to provide heat for the house for the remainder of the heating season.



Most utility companies actually offer a rebate incentive for this type of hybrid operation through a category called Integrated Controls that offers the consumer incentive money (some programs as high as $500 per control/max [three] per house). For the control to qualify, it must be able to operate the heat pump in both heating and cooling mode. It also has to be able to measure the outdoor temperature and, at a pre-determined temperature in the winter, turn the heat pump system off and turn on the legacy system to maintain space temperature. Of course, as the outdoor temperature climbs, the control has to turn the legacy system off and bring the heat pump back system back on seamlessly. The switch-over temperature is usually referred to as the *balance point*. This point becomes the outdoor temperature where the heat pump can't provide enough BTUs and/or it does it at a higher cost than operating the legacy system. When the switch-over takes place, the integrated control must to be able to turn the heat pump system completely off and only operate the legacy system. Some of the Integrated Controls that have been approved for this type of control are heat pump thermostats with WiFi capabilities. Through a smart phone or tablet, the consumer can operate their heat pump and legacy system to control space temperatures in their home.

If you have any questions or comments, e-mail me at *gcarey@fiainc.com*, call me at (800) 423-7187, or follow me on Twitter at *@Ask_Gcarey*. **ICM**