

Choosing A Heating System

(And Maybe Cooling Too)

It used to be so simple to choose a heating system in New England - it would be a forced hot water system powered by a gas or oil boiler. On MV, people rarely asked for a cooling system. The boiler made the hot water as well. Then we started to think about the effect of burning those fossil fuels, and we learned about climate change, carbon emissions, oil spills, fracking and peak oil, and we wanted to find a better solution. And the perception was that it was getting hotter, so more people were asking for cooling.

During this time, and especially recently, the size of the heating demand of our houses has dropped considerably. We superinsulate them, we build them airtight, and we use triple glazed windows with coatings that dramatically reduce heat loss. A family-sized house today might have a maximum heating load of 20,000 BTU/hour or less. The smallest oil boiler has an output three times larger than that, meaning that on a typical winter day it might be five times larger than needed. This level of over-sizing reduces the operating efficiency.

If we want to leave fossil fuels behind and use a renewable fuel source instead, we rely on renewably generated electricity, usually from a solar electric system. Firewood is a low cost, renewable fuel, but as a primary heating system it has the drawback of needing human input and attention - it isn't automated. So a wood-burning stove might be great in a power outage or as a supplemental heat source, but not as the primary heating system for the house.

Renewably produced electricity, leads us to heat pumps as the heating and cooling plant. Heat pumps have a number of benefits besides being driven by renewable (electrical) energy. They have no combustion and require no fuel storage, so they are safer than fossil fuel systems. They come in smaller capacities more appropriate to the needs of the modern superinsulated house. They are capable of providing cooling as well as heating, and they are very easy to use when there is a need for separate zones of heating.

Heat pumps are devices that move heat from a colder place to a warmer one. For example, a refrigerator is a heat pump, moving heat from the cold refrigerated compartment to the warmer room. This takes energy and heat pumps are powered by electricity. The source for the energy the heat pump is using is either the ground or the air. Ground source heat pumps (GSHP) are commonly called "geothermal" but this is a misnomer. The ground can be sourced using either wells or networks of buried piping. This is a big ticket item so GSHP systems have been the highest cost systems SMC has installed. They are also complex, and we and our colleagues have seen some reliability and performance issues.

Fortunately, the other alternative source is the outdoor air. Air source heat pumps (ASHP) are self-contained, and consist of an outdoor unit and one or more indoor units, similar to a conventional central air conditioning system (but a lot quieter!) The revolution in ASHPs occurred when the Japanese began to export their advanced inverter-driven minisplit heat pumps. In practice, the best minisplits yield similar efficiencies to the best GSHPs at a fraction of the cost. And they supply cooling too, while delivering twice as much heat to our houses per dollar of energy than the fossil fuel systems they replace.

The simplest minisplit system consists of a single outdoor unit the size of a large suitcase, and a cassette mounted high on a sidewall that supplies heated air in the heating season and cooled air in the summer. We've done homes with as

many as seven of these indoor units, each its own heating and cooling zone, on one or two outdoor units. And some of our smaller, superinsulated houses get by on just one indoor unit and one outdoor unit.

Some of our clients prefer to not see the wall cassettes and minisplit technology has expanded to include alternatives to wall cassettes. There are floor mounted cassettes that can be built into casework. There are concealed ducted units, that serve ducted distribution systems similar to traditional forced air systems so the only visible aspect of the system are the grilles and registers. The Japanese ASHP ducted systems differ from traditional forced air systems in that they are easily zoned and are much quieter. Ducted systems, as one might imagine, are more complex and therefore cost more than the installations based on wall cassettes.

At this point, Japanese minisplit heat pumps are our overwhelming favorite recommendation for heating and cooling your SMC home - in fact, we've used almost nothing else since they became available some years ago.