



SELECT AN ENERGY EFFICIENT HEATING & COOLING SYSTEM

Step 9

Reducing the energy required for heating and cooling is essential to meeting the net zero goal. Air-source heat pumps are the most efficient heating and cooling system currently available. Air-source heat pumps take heat out of the air, even when temperatures fall below zero, and move it as hot refrigerant through a small pipe to one or more indoor units that deliver heat into the house. In the summer, air-source heat pumps remove heat from the home, even when temperatures are above 100°, and deliver cold refrigerant to the indoor units.

Ductless Heat Pumps

Air-source ductless heat pumps (DHPs) require no ducts or water pipes and are sometimes referred to as mini-splits. In addition to saving energy, they cost less to install and create only two penetrations in the building shell. DHPs can be sized accurately to meet the needs of small, efficient homes, which makes them a good match for many zero energy homes.



Energy Efficiency

Choose a highly efficient model with a heating season performance factor (HSPF) rating of 10.5 or higher and a seasonal energy efficiency rating (SEER) in the mid to high 20s. There are many DHPs on the market that meet this target. If you're building in a colder climate, be sure to select a model that will perform well down to -10° F and that they are sized correctly for the specific heating and cooling needs of the home.

DHPs owe much of their efficiency to variable speed operation. DHPs operate very slowly when the heating need is low and then speed up when the need is high resulting in very stable room temperatures. Most conventional heating systems (including central systems, ducted heat pump and hot water systems) only have one speed and turn on and off in an attempt to keep the living space at a constant temperature.

Distribution

DHPs deliver heat or cold, depending on the season, to a mini-split – an inside unit that usually hangs on a wall or can be recessed into a ceiling. In a smaller home with a more open floor plan only one or two mini-splits may be needed to distribute heat or cold to the entire house. In larger homes, where heating and cooling diverse spaces are necessary, a somewhat less efficient ducted mini-split uses relatively small, short ducts to reach different rooms or may share ducting with the ventilation system. Since warm air rises and cool air falls, there will be a special challenge with two-story homes. A two-head DHP allows one unit to be installed upstairs and one downstairs to cover both heating and cooling needs more effectively.

Cold Climates

In cold climates, be sure to select a cold climate rated heat pump. They work well even when the temperatures are -10° F, provided they are sized properly. In very cold climates a simple backup heating system, such as one or more electric resistance wall heaters, can be installed in the bathrooms or areas not well served by the DHP. These heaters will be used rarely or not at all, but they provide inexpensive insurance in case of extreme weather or heat pump failure.

Warm Climates

High SEER mini-splits cool much more efficiently and are more quiet than standard air conditioners.

Proper Sizing

DHPs work well in small- and medium-sized, efficient homes. The energy model will suggest the proper capacity in BTUs per hour at the lowest expected temperature. The lowest expected temperature is called the “design heat load” of the building. Heating and cooling equipment is sized for this worst case temperature, called the “design temperature.” There are few hours of the year that reach the design temperature. Recent research has shown that it's important not to oversize the system, as is commonly done with other types of heating equipment. Oversizing can lead to excessive “cycling” when the system turns on and off much too frequently. This happens when the outdoor winter temperature is warmer and the equipment capacity is too great. The thermostat is rapidly satisfied and the unit shuts off, only to come on again very soon. Within normal temperature ranges, properly-sized equipment will run for longer periods at slower speeds providing for more even temperatures and more efficient operation. Only during the short periods that the design temperature is reached, will properly sized equipment run continuously on high speed. It's okay to match the DHP size to the expected design heat load and then install small electric heaters in case of emergency.

Installation

Houzz.com has a page with [over a thousand photos of well designed mini-split installations](#).

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