

HOME ENERGY GUIDE

AIR CONDITIONING

Air conditioning operates on the same principles as a refrigerator: a refrigerant is compressed from a gas to a liquid and when it changes back to a gas, energy (in the form of heat) is absorbed. That captured heat is expelled to the outside, lowering the temperature inside the house. Additionally, as air is cooled it is less able to hold moisture, so the air inside the house becomes drier—which is more comfortable for the occupants.

All air conditioners consist of a condenser unit, which sits outside the house and serves to condense the circulating refrigerant, thus releasing the captured heat to the outside. The now-cold refrigerant is pumped to the evaporator, which is located inside. As the fan blows air over the evaporator it transfers its heat to the refrigerant. The air that is distributed is now much cooler, and the warmed refrigerant is pumped back outside to the condenser to start the cycle again.

Distributing the cool air

The actual equipment that accomplishes the “conditioning” of indoor air comes in several forms, depending on the type of distribution system in the home.

Ducted or forced-air systems

The most common type of distribution system uses the same metal ducts and a fan that move heat created by a furnace—the forced-air system. The ducts can also serve as pathways for cool air; this system is commonly known as central air conditioning. Usually controlled by the same thermostat that operates the furnace, central air offers the convenience of cooling the entire house, while allowing for adjustments (through baffles and registers) in individual rooms.

Ductless systems

Ductless systems work well for homes that use hot water or steam for their heating systems,

and thus do not have traditional ductwork. Small tubes run between the outdoor condenser and the indoor wall-mounted unit, forming a closed-loop system. The cooling component is mounted on the walls of one or more rooms and resembles a room air conditioner, but it is much quieter. The condenser is installed outdoors, similar to a central air conditioner. Some ductless systems will support multiple terminals and may have a cooling capacity equal to traditional central air systems. Another advantage of the ductless system is the ability to cool only selected rooms.

High velocity systems

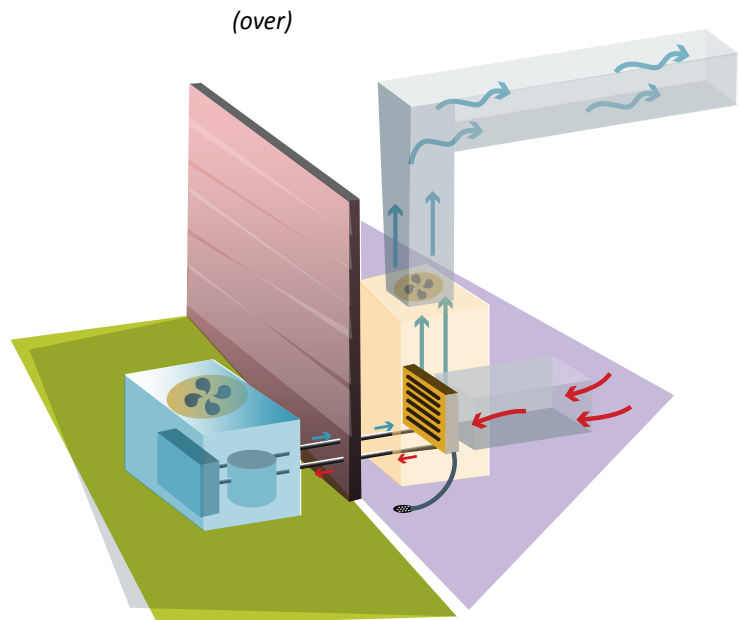
Another option for homes without traditional ductwork is the high velocity system, which uses smaller ductwork that can be placed within existing wall cavities. Main trunks may be only six inches in diameter, with delivery ducts only three inches in diameter. Along with the outside condenser unit, the systems

Where does the moisture go?

A significant effect of air conditioning is the removal of moisture—a result of cooling the air. But where does it go?

In a central air system, the moisture is collected in the evaporator within the furnace ductwork. This water, or “condensate,” is carried away by a hose to a nearby drain. It is very important this hose remain open and connected to the drain. Condensate backup (due to clogs, pinches, or bends in the hose) will spill onto the floor, adding moisture back into the air and causing potential damage.

Window units also have a drain, which empties outside. Often a drain line will need to be attached to assure the condensate is draining away from the window frame and building.



include an air handler with a higher velocity fan that blows air over the evaporator unit and then through the smaller ducts. Although sometimes challenging to install, a high velocity system can deliver cool air throughout the home and allows for individual room controls through registers.

Window/wall units

Most common in rental units and older homes, window/wall air conditioners can provide cooling to a limited area in a home—usually one or two rooms at most. A window air conditioner combines the condenser and evaporator elements into one unit that sits within an open window frame. A wall unit is similar except that it sits in a separate opening in the wall. The condenser portion is on the outside and expels the heat, while the room air is circulated over the evaporator on the inside, providing cooling into the room. Proper installation of window units will prevent air leakage around the unit (through insulated “filler” panels and other tight-fitting gaskets) and will provide a way to secure the window to prevent opening from the outside.

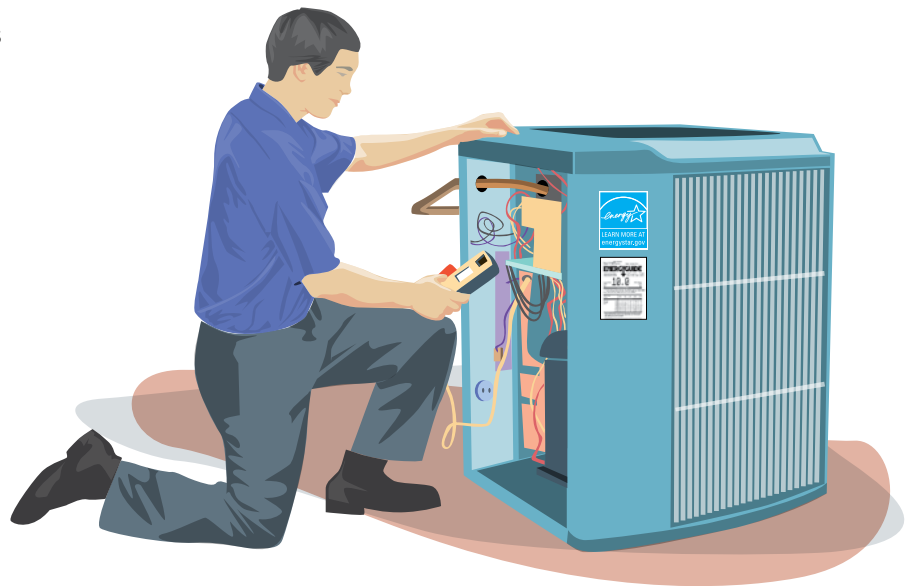
Additionally, it is important to make sure the electric requirements of the unit are not more than the circuit it is using.

Saving electricity with a central air conditioner

Some electric utilities offer billing options that include lower rates for off-peak use of air conditioners, often during evening hours.

Additionally, many will provide a discounted rate when a homeowner agrees to allow the utility to remotely control the operation of the condenser portion of the unit during periods of high electricity demand.

Usually the interruptions are not noticed by customers (circulating fans remain operational, and the “down” times are usually short). The benefit to the utility is better management of electric demand, which means the ability to avoid relying on expensive generation during peak usage events.



Fuels for air conditioning

The primary fuel used to provide air conditioning is electricity. It is required to operate pumps, fans, and condensers. In many homes, air conditioning represents the largest portion of electric usage, on an annual basis.

A solar absorption chiller can provide the energy required to convert the refrigerant to a gas instead of using a compressor.

In a gas absorption chiller, like a gas refrigerator, the pump that is used to force the refrigerant through the compressor is run by natural gas instead of electricity.

Ground source and air source heat pumps can also provide cooling, and in some cases can be a very effective use of these technologies. With a ground source heat pump, the fluid coming from the loop field is already cool—about 55 degrees—so it is relatively simple to circulate through the distribution system. Air source heat pump units can also provide cooling, but careful design and proper installation will determine effectiveness and efficiency—especially when compared to other alternatives.