Whole-House Ventilation Strategies

Whole-House Ventilation Strategies for New Houses

Best practice among builders of modern high-performance homes in most North American climates is to build as tight as possible, and then ventilate with a well-designed mechanical system. Even though this uses a little energy, you are likely to save more heating and cooling energy from having a tight house than you will use to ventilate. Mechanical ventilation is achieved in one of three ways: exhaust-only, supply-only, and balanced. To varying degrees, all of these strategies are more economically installed in new houses and more difficult to do as retrofits, because access in existing houses may be poor.

Exhaust-Only

Exhaust fans (kitchen, bathroom, and/or whole-house fans) tend to “depressurize” the building, causing infiltration of outside air through any cracks or openings it can find. In the North, where winter is more intense than summer, exhaust-only ventilation may be adequate without inviting damage from moisture. Because summers tend to be short and moderate in cold climates, except for a few days, the building is unlikely to be damaged by occasionally drawing in very hot and humid air through the structure. Conversely, exhaust-only ventilation strategies should not be used in the South. If hot and humid air is drawn into the building for months on end, condensation, mold, and damage are likely to develop.

Supply-Only

Supply ventilation systems draw clean outside air into the interior living space, usually through a supply vent that feeds into the return duct of a forced air system. Advantages of supply-only ventilation include the ability to control where incoming air is coming from, treat the incoming air, and minimize humid air that is pulled into the living space. Controlled supply also minimizes the potential for combustion appliance backdrafting, a dangerous type of uncontrolled infiltration that is more common in well-sealed and poorly vented basements. Supply-only strategies will “pressurize” the house, which keeps moisture out in hot, humid climates but may cause moisture to condense in walls in cold climates as warm air escapes to the outside. This can be very damaging.

Balanced

Balanced whole-house ventilation systems exhaust indoor air and supply outdoor air in roughly equal amounts. This way the pressure of the interior space stays relatively constant, although this is rarely perfect. Balanced ventilation is essentially a well-controlled combination of the exhaust and supply strategies discussed above, but it takes a very tight house and good engineering. Often, a balanced system involves a powered heat recovery or energy recovery ventilator (HRV or ERV) that improves efficiency and pressure balance by exchanging energy (from temperature and humidity differences) between the outgoing and incoming airstreams. HRVs transfer only sensible heat while ERVs also transfer moisture from humid air. The relatively large electric power use of ERVs and HRVs generally make them a luxury option in mild climates and should not be considered as an economic option for most existing buildings.

Whole-House Ventilation Strategies for Old Buildings

For old buildings, creating the kind of tight construction that would make installing a mechanical ventilation system worthwhile is probably difficult and economically risky. If you live in an old building, the first question to ask is whether a whole-house ventilation system is needed at all. Is your house displaying any symptoms? What are your main comfort concerns? Have you conducted a radon test? If you have limited complaints, it would be most cost-effective to simply take the “first steps”: control sources, exhaust local sources, and keep your filters clean and your ducts tight.

Local Exhaust

If you live in a hot-humid climate, exhaust-only ventilation can depressurize the house. This could drive humid outdoor air into the wall cavities, where it can condense and cause grave mischief. It is better to consciously introduce outside air into the house than have it infiltrate through the walls. However, you’re unlikely to get into trouble by using exhaust fans in moderation, and by opening the windows occasionally when it feels stuffy or the exhaust fans have been on for a long time.

Managing your Current System

If you have an existing forced-air system, it is likely that your thermostat has a switch for controlling the furnace fan. In “auto” mode, the fan runs when the furnace or air conditioner (or heat pump) is running, and for a short time afterwards. When the switch is set to “on,” the fan runs continuously. Full-time fan operation will certainly move more air through the filter, and encourage more even distribution of conditioned air throughout the building, but it is not a good idea because it will waste a large amount of energy. In the air conditioning mode, continuous fan operation is a really bad idea and should be avoided. When the air conditioner is operating, it removes humidity by cooling the air to perhaps 50ºF to 55ºF, cold enough that the ability of the air to hold moisture is very low. So, the water condenses out, onto the coils and fins of the air conditioner evaporator. If the fan stops soon after the condensing unit shuts off the compressor, most of this water drips off the evaporator and goes out through a drain line. However, if the fan runs continuously, that water is instead re-evaporated and circulated through the house. This leads to cold-clammy houses.

Natural Ventilation

Natural ventilation is usually employed as a cooling strategy, but in principle, the idea is to replace stuffy indoor air with cool outdoor air. In order for it to be most effective, the incoming air should be cooler and dryer than the inside air, making this strategy most effective in milder climates, at night, or on cooler, drier days. Keep the house closed up on hot days and try to limit unwanted heat gains and then ventilate the house at night. In breezy locations, natural ventilation can be provided simply by opening screened windows. Plantings and fences can be used to help funnel breezes towards your house. If there isn’t much wind, you’ll need to provide mechanical ventilation with either window fans or a whole-house fan. These are explained in the section on [cooling](https://smarterhouse.org/home-systems-energy/cooling-systems).

Whole-House or Room Dehumidifiers and Humidifiers

There are many situations, particularly in hot climates, in which conventional air conditioners do not remove enough moisture. This is particularly true on very humid days with moderate temperatures (in the 70s).Under these conditions, the air conditioner probably will not run enough to remove the moisture load. New dehumidifiers are now available that install in place of a section of central ductwork, so they dehumidify (but reheat a bit) all the air circulating in the house. These are more expensive than room dehumidifiers, but may be very effective when nothing else works.

Excessive and continuing static electricity buildup in winter is typically taken as a sign that the relative humidity in the house is too low and should be increased. With forced-air systems, this is generally accomplished by adding a humidifier that injects water vapor –— or very fine water droplets — into the supply air near the furnace. Before taking this step, remember that a very dry house through the winter is generally a sign of excessive infiltration. See if you can reduce the leakage, thereby saving energy and increasing comfort.

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