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HRVs vs. ERVs

Energy Recovery Ventilation, or ERV, is the term applied to devices that have either vapor permeable heat exchange cores or desiccant wheels capable of transferring moisture between air streams with high vapor content to air streams with lower vapor content. HRV (Heat recovery ventilation) employs a cross flow or counter-flow heat exchanger (countercurrent heat exchange) between the inbound and outbound air flow. HRV provides fresh air and improved climate control, while also saving energy.

I found it very encouraging that within the last month I have had three people ask me about the differences between HRVs and ERVs. All three were technically savvy builders, 2 with large single family home builders, one from a leading high rise condominium developer. This signals to me that we are seeing a much deeper interest in ventilation options and technologies specifically and in HVAC systems generally and this is a very good trend. It does mean we all have to understand at a much deeper level the physics of buildings, in this case the physics of moist air in residences. This empowers us to make more informed decisions when presented with products or opinions from contractors, consultants and manufactures.

It was clear from my conservations with the three builders that they and their HVAC contractors feel they have been getting mixed messages about the application of ERV technology vs. the older HRV technology. The two areas of discussion are about whether ERVs help maintain proper humidity levels in buildings and whether ERV technologies are suitable or durable enough for cold weather applications.

Let's start with a quick review of the humidity issue. Moisture in houses is good, moisture in houses is bad. Too little and people complain of dry skin, electric shocks and house components shrink, crack and warp. Too much and we get condensation on windows in winter and mold in basements in summer.

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We have always wanted and needed moisture balance, it is not a new issue brought on by HRVs or any other single technology, rather it is a progression of material, process and installation changes and consumer expectations. Therefore THE BALANCING ACT HAS CHANGED AND GOTTEN MORE COMPLICATED.

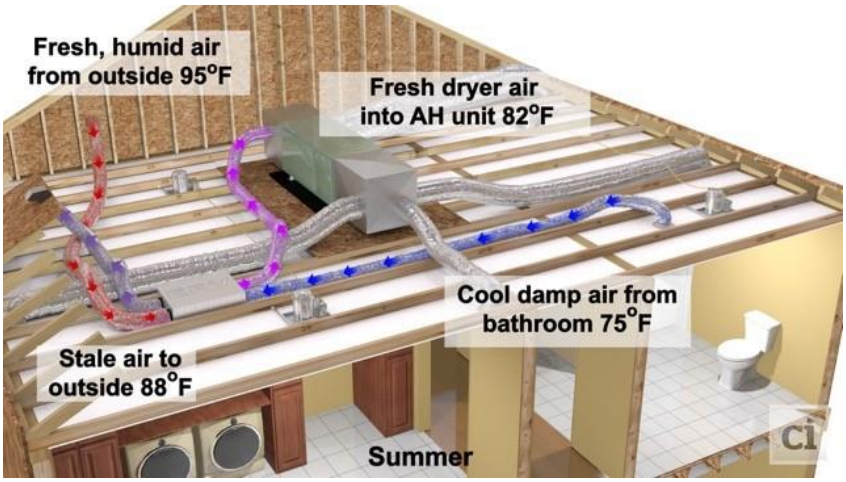
The capacity for continuous ventilation has been a national and provincial building code requirement since 1990. Builders have to install the capacity to ventilate houses on a continuous basis and homeowners can choose exchange of stale, moist exhaust air with fresh, outside air) has the capacity to remove a lot of moisture on a cold day - its just physics. 60 CFM (enough for a 3 bedroom house in most codes) of ventilation will remove 20 liters/5.2 Gallons of moisture per day from a house when it is -10C/15F outside (that is about 0.9 liters per hour/.96 Quarts). By comparison a typical house with a typical family at home a typical amount of time puts about 20-30 liters / 5.2-7.8 Gallons of moisture into the air each day.

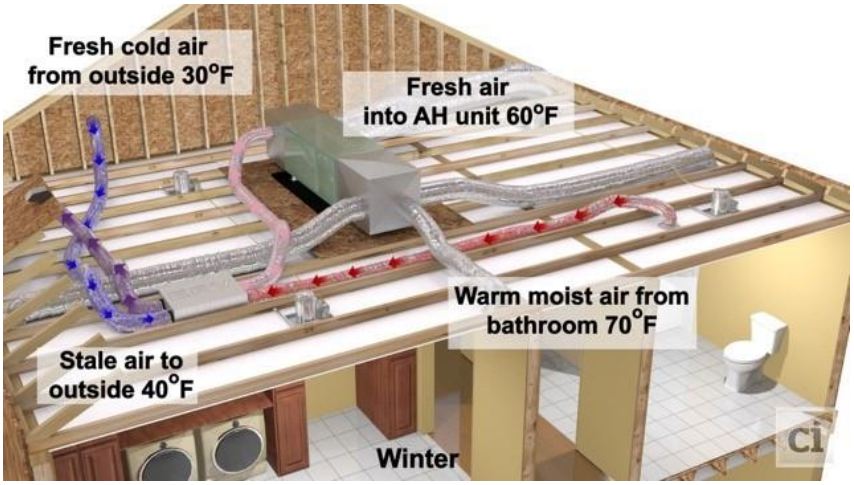
It is also important to note that ventilation is meant to not only help control moisture but also to exhaust other contaminants and bring in fresh air for occupants. So you don't just want to control the operation of ventilation systems based on moisture alone.

So HRVs were developed and applied specifically for the removal of winter moisture in R-2000 and other energy efficient houses. HRVs were originally often just used as winter dehumidifiers. Homeowners ran them off of dehumidistats so that if the RH was too high (typically above 45-50%) the HRV ran more, if the house was too dry (below 30%) they turned them off. But what if a homeowner wants continuous fresh, healthy air in winter, even if moisture levels are low? Ventilation would make the house uncomfortably dry. There are at least three alternatives:

1. Use a combination of humidity and timer based controls to ensure a balance between regular ventilation for fresh air and moisture control is achieved.
2. Add humidity if and when the humidity levels drop below 30%. Humidifiers are, of course, a common technology that has improved dramatically over the last 10 years.
3. Replace HRV technology with an Energy Recovery Ventilator (ERV). ERV is the term applied to devices that have either vapor permeable heat exchange cores or dessicant wheels capable of transfering moisture between air streams with high vapor content to air streams with lower vapor content. Typically flat plate ERV cores have latent effectiveness of up to 50%, while ERV dessicant wheels have an effectiveness of over 70%.

In the winter condition noted above an ERV with a latent effectiveness of 50% would cut the 20 liters/5.2 Gallons of moisture removed by ventilation per day in half. There is nice difference in summer as well in any climate zone that has significant air conditioning loads. ERVs transfer at least 50% of the moisture from the incoming fresh, hot and humid air to the to the exhaust air going out. Of course in most parts of Canada and the Northern U.S. States, the air conditioning season is short. ERVs can rarely be justified on energy savings in this short season alone but the incremental cost for ERVs can often be justified on the capital cost savings in air conditioning capacity required to maintain adequate air quality at summer design conditions. In warmer U.S. climate zones, such as a mixed humid climate like Dallas, TX an average sized home can see a 1/3 ton reduction in latent and sensible cooling loads, in addition to the aforementioned air quality improvements at design conditions.





In short ERVs help maintain a healthy, comfortable moisture balance in buildings without compromising ventilation rates or operation schedules. They may not eliminate the need for humidifiers in some larger, sparsely populated buildings that have few moistures sources but they would reduce the humidification load. In addition, there are some great new controls both from the thermostat professionals and ERV manufactures that make humidity control much easier. For example the latest ERV “smart” controls automatically measure outside temperature, inside temperature and indoor RH and adjust both the amount of ventilation and the schedule of operation during

different seasons to keep RH levels in a comfort zone between 30% and 50% year round – no more dehumidistat knob that no one could remember how to use.

The second important discussion is about the longevity or durability of ERV cores in cold weather applications due to freeze / thaw cycles in the core materials. The first residential ERV technology was introduced 25 years ago in Canada and they quickly delaminated in cold weather testing, I saw it first hand in a test lab in Saskatoon at -25 C / -15F when a core blew itself apart in about 8 hours. These original core materials are still used successfully in southern climates but are not rated or recommended for Canadian use. Fortunately there has been progress in the last 25 years. At least 2 Canadian manufactures (and other international companies) make core or wheel materials that have been rated for over 10 years by the independent test lab at the Home Ventilating Institute (HVI) down to -25 C/-15F. There are thousands of units that have been installed by progressive HVAC contractors and builders in Canada and they are working very well at helping maintain the moisture balance in buildings and thereby reducing customer complaints about overly dry houses in winter and sticky houses in summer.

Feel confident in assessing the individual needs of clients with respect to the moisture balance. Measure and monitor the relative humidity in all buildings and look for signs of moisture issues. Then offer ERVs as one great solution for the best overall control of moisture in homes both summer and winter, without compromising ventilation rates.

Characteristics of dry homes in winter (<30% RH):

- Dry skin & nose bleeds
- Static shocks
- Cracked floors or furniture
- Looser construction
- Fewer occupants or activities

Solutions:

- Air seal to save energy and control moisture
- Add humidity
- Use an ERV for ventilation to avoid additional drying

Characteristics of wet homes in winter (>45% RH):

- Musty odors
- Window condensation
- Tight construction
- Lots of occupant activity

Solutions:

- Use spot ventilation in bathrooms & kitchens
- Turn off humidifier
- HRVs may be best

Characteristics of wet homes in summer (>55% RH):

- Musty odors and mold
- Damp basements
- Poor drainage or water management
- Lots of occupant activity

Solutions:

- Fix drainage issues
- Size air conditioning properly
- Use a dehumidifier in basements
- Use an ERV for ventilation