Tech to Tech Column—February 09
HRV's & ERV's

Because of energy cost fluctuating up and down like a see saw then leveling out at a higher price than before and the "green" trend, homeowners and builders alike are installing thicker insulation, energy saving doors, windows and vapor barriers in an effort to make their homes 'tight', to keep the heat in the house longer. *The relatively low energy prices we are seeing today are only because of a slump in demand around the world and won't last long.

The down side is when natural ventilation (air infiltration) is reduced or eliminated; indoor air pollutants, stale air and high humidity are locked in also. Proper ventilation is required to prevent this situation because the greater the air exchange, the greater the chance to eliminate these irritants. While opening the windows would prevent this situation it would also defeat the purpose of an energy efficient home.

Many homes have **high humidity** levels and unless the home is showing signs of high humidity that can be seen, the home owner can be completely unaware of this serious problem.

High humidity levels inside the dwelling can create mold and mildew that can irritate allergies and other health problems while the excessive moisture (condensation) can accumulate on walls, ceilings and windows deteriorating building materials leading to expensive repairs.

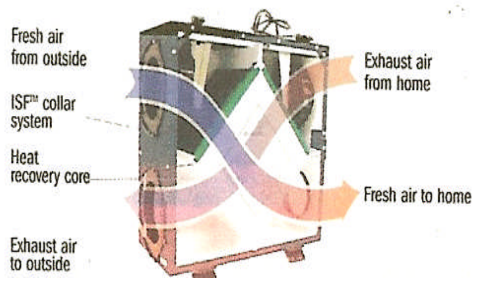
Contaminated air has a higher number of particles of a given substance than the maximum allowable limit. These substances come from many sources and pollute the air in varying degrees. They have been known to cause illnesses such as allergic reactions, headaches, dizziness, and nausea to name a few.

The following is a list of some of the potential contaminates in your house and their sources:

➢ **Radon**: stone, soil, water, brick, concrete, ceramic tiles, gypsum board
➢ **Formaldehyde**: foam insulation, plywood, particleboard, paneling, fabrics, furnishings, kitchen counter tops, wallpaper, protective coating for wood floors, carpet adhesives
➢ **Nitrogen Oxides and Carbon Monoxide**: Gas & oil stoves, vehicles, smoking, cooking, wood stoves, kerosene heaters, furnaces
➢ **Organic Compounds**: Aerosol sprays, smoking, cleaning agents, carpets, wall coverings, linoleum, waxes, adhesives, fabrics, rubber, plastic, paints ➢ **Particle Pollutants**: Smoking, cooking, gas stoves, dust
➢ **Ozone:** Aerosol, electronic air cleaners, photocopying machines, direct current electric motors
➢ **Benzopyrene:** Cigarette smoke
➢ **Chlordane:** Pesticides used for pest control

Both Heat Recovery Ventilator's & Energy Recovery Ventilator's are simple devices that bring in fresh air and remove stale air, they save the consumer a substantial amount on reheating or cooling and dehumidifying or humidifying the entering air depending on the season. Both have heat exchanger cores, one or more fans to push air through the cores and controls.

There are two types of systems--**Exhaust only systems**—that have a fan to provide exhaust air; the supply is not fan powered and **Balanced systems**—that use a fan powered exhaust airflow that is designed to equal the fan-powered supply airflow. One fan draws outdoor air in while another fan blows an equal amount of stale room air outside. Both fans blow the air through a



central heat-exchanger core that extracts the heat from one air stream and transfers it to the other but does not mix the air streams together. In most units the incoming air is filtered on its way through.

Balanced air, stand alone ducted systems allow equal amounts of air are to be supplied and exhausted making the home more evenly ventilated, avoiding drafts and uneven ventilation while bringing fresh, drier air into the home.

The most common HRV/ERV's are duct-connected house units. The duct connected units are more effective because they provide for a better distribution/pickup of the air through the homes HVAC system. The fan component of a duct-connected system is commonly installed in the utility room or furnace room.

Types of Heat Exchanger Cores: Manufacturers use different methods to accomplish this transfer of heat and/or moisture. Some send opposing air streams through alternating layers of aluminum plates, while many of today's residential HRV's are using polypropylene cores that do not transfer moisture and many residential enthalpy type exchangers, better known as ERV's, use a core made of a paper based permeable material that allows some moisture transfer.

Heat Recovery Ventilators: HRV's are recommended in colder climates with longer heating seasons and only recover sensible energy (heat transfer).

Condensation collects in most HRV's when warm, moist air contacts the exchanger's surfaces in very cold weather; this can freeze, blocking airflow. Liquid condensation is collected in a condensate pan or carried away by plumbing. In the heating season, HRV's transfer heat from the exhaust air stream to the incoming air stream warming the cold entering air. In the air conditioning season, heat is transferred from the incoming air stream to the exhaust air stream cooling the hot and/or humid air.

HRV's can cause dryness in the heating season because they only transfer heat and not moisture. If this occurs you may need to use a humidifier or temporarily reduce airflow.

Energy Recovery Ventilators: ERV's are recommended for warmer more humid climates with long cooling seasons.

ERV's recover sensible and latent heat (moisture), transferring heat and moisture from the exhaust air stream to the incoming air stream during the heating season, and heat and water vapor from the incoming air stream to the exhaust air stream during the air conditioning season.

An ERV works best when operated constantly. The moisture transfer keeps the core above dew point temperatures, preventing the core from freezing in all but the most extreme conditions.

Because ERV's transfer moisture they do not produce condensation. Water vapor is transferred with a rotating wheel with desiccant material (usually on commercial applications) or permeable plates.

The argument for/against installing ERV's in Colder Climates: There are people on both sides of this issue and from all I have read it is a matter of preference. Everyone I talk to here in the northeast swears you should use an HRV.

They claim the performance difference is not great enough to justify using an ERV in colder climates and it is better to have a humidifier to add humidity. They also say the potential damage to the paper based permeable filter material from frozen moisture can lead to air leakage, loss of efficiency and airflow.

While researching this article I found many saying just the opposite. They said the fact that the ERV doesn't remove as much humidity in cold whether from the home, doesn't produce condensation (but has moisture and can freeze), would require defrost only in the coldest days, doesn't have significant airflow restrictions unless the outdoor temperature is below zero and will deliver drier air above 40 degrees Fahrenheit make it a great choice for this region.

ERV supporters also claim that the HRV will spend a considerable amount of time in the defrost mode in our region, effecting the airflow and ventilation of an HRV.

The one thing that stands out to me is whichever you use in this region; it might be a good idea for it to have the capability of defrosting itself.

Efficiency: The efficiency of ERV's refers to the amount of temperature adjustment of the incoming fresh air that the outgoing stale air can accomplish in the heat exchanger.

Many manufacturers claim that both of these units are capable of recovering 70 to 85 of the heat and/or moisture depending on which unit you have.

The Home Ventilating Institute (HVI) has a standard test for units manufactured in the United States. Not all manufacturers have been tested, so it is necessary to examine efficiency claims to see if the efficiency claims are HVI certified or manufacturer's data to get a true comparison. All units sold in Canada are subjected to a standard test (R 2000), which is almost identical to HVI's test.

Options and features:

- Heat recovery with or without moisture transfer
- Defrost control to prevent ice build up the recovery module (this should be standard in cold climates).
- Single or multi-speed controls
- Pollutant sensor controls
- High efficiency air filter on incoming air

<u>Installation: as always refer to the Installation Manual</u> for the exact instructions for the HRV/ERV you are installing. They contain just about anything you will need to know to get the unit up and running. The following is some general rules to follow:

Both of these units are typically installed in attics, crawlspaces, or storage/utility areas. The most common mode of installation is in a ducted air system, but can be used in a stand-alone application also.

In ducted systems the fresh air supply is placed into the existing return duct work. They require two connections to the outdoors-one to exhaust the stale indoor air and the other to bring in the fresh outside air.

Ducts must be tight and avoid excessive elbows and other practices that will cause resistance to airflow. Ducts located in unconditioned spaces must be well insulated (especially if the fan speed is intended for continuous operation—consider R-19 wrap).

The inlet and outlet on the building exterior walls need to be solid connections and distanced from each other to avoid cross contamination.

Be sure that the inlet pulls air from clean location (away from flues, dryer vents, standing water, or near exhaust fumes. It is preferred to have the inlet and the outlet on different sides of the house.

In stand alone installations, fresh air from the unit into the home's interior can be supplied in two ways. A separate supply duct can carry the fresh air to a central location in the House. This supply outlet is best located where the air will not blow on people, since the air can be too cool or too warm depending on the season.

In either case, the CFM quantity of fresh air coming in and the stale air being exhausted must be balanced. Balancing is important for ASE (Apparent Sensible Effectiveness) and to avoid over-pressurization or depressurization of the home.

*** Note: When installing an **ERV** (in ERV designated areas) and the outdoor temperature falls below 23 degrees Fahrenheit (5 Celsius) for more than two days, it is recommended to install a defrost kit.

Maintenance should always be done according to manufacturer's guidelines but here are some general procedures.
Typical maintenance includes:

- Cleaning and re-coating with filter adhesive (if applicable) or replacing the air filter every 3-6 months. Clogged filters lead to airflow restriction.
- The energy transfer (ERV) permeable core can be cleaned by lightly vacuuming with a soft brush attachment. Most manufacturers do not recommend washing or submerging the core.
- Polypropylene cores for HRV's can be washed.
- Clean or unblock outside hoods and screens annually. They can become clogged with lawn debris, insects, and windblown material.
- Clean the energy recovery core every six months
- Clean condensate drain and pans every 6 months
- Service (oil if applicable) and clean fan motors every 3-6 months
- Annually clean grilles and inspect ductwork for leaks or obstructions
- System airflow should be balanced annually

When sizing a unit the contractor will need to consider airflow capacity in CFM and Recovery efficiency of the unit when determining what size unit he needs. Most manufacturers recommend they are sized to ventilate the whole house at a minimum of 0.35 air changes per hour.

For new homes the mechanical ventilation requirement is for airflow and does not require energy recovery, although many states in the US either require or have legislation pending requiring mechanical ventilation. This is already the law in Canada.

Caution: ERV and HRV airflow can decrease by up to 50% after one month of use due to the core and pre-filters becoming dirty. You may want to consider this when sizing.

<u>There are many simple methods of sizing these units but make sure you follow any local codes when sizing for residential use:</u>

The people method is base on 15 CFM for each person living in the dwelling.
For example—6 occupants X 15 CFM = 90 CFM

Volume ventilation method, Square Feet of House including basement (L X W X H)	2000 Sq. Ft.
Total Sq. Ft.	2000 Sq. Ft.
Height of Ceiling (use actual height)	X 8
Cubic Volume	17,600
Divide by minutes in an hour	/ 60
	293
Multiply by desired air changes	X 0.35
Minimum Airflow Required (CFM)	103 CFM

One CFM per 100 Sq. Ft. of floor space, for example: 2400 Sq. Ft. x1 CFM = 240 CFM.

Another method adopted in some states is based on the number of bedrooms with a minimum airflow of 15 CFM/per bedroom + 15 CFM and a total ventilation capacity equal to 0.05 CFM X sq. ft. The requirement for a 1600 sq.ft, three bedroom home would be (3 bedrooms X 15 CFM per bedroom) + 15 = 60 CFM. The total ventilation capacity must be at least: 1600 sq.ft. X 0.05 CFM/sq.ft. = 80 CFM; therefore the system must have a minimum ventilation capacity of 80 CFM.