# The Low Down on How to Ventilate a Home, and Why

EnergyLogic

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Former custom home builder in Colorado's Vail Valley. A curiosity in energy-efficient building methods led me to become certified from RESNET®, BPI, and CSU's School of the Built Environment.

Currently, Director of Business Development at EnergyLogic, an applied building science company that partners with building professionals to create homes that are efficient, healthy, and resilient.

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# Who is Today's Audience?

- Builders
- Raters
- Building Inspectors
- Architects
- Mechanical Contractors
- Other

# No COVID–19 Talk Today!

- Virus transmission is very complex.  While a whole-house ventilation system should not increase the transmission of virus'; I am not comfortable stating that they will reduce the transmission.
- I am exhausted of thinking about and discussing Covid!!

# Is Whole House Ventilation a Good Idea?

*Hint – The Answer is Yes!*

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# Fresh Clean Air – a Good Thing

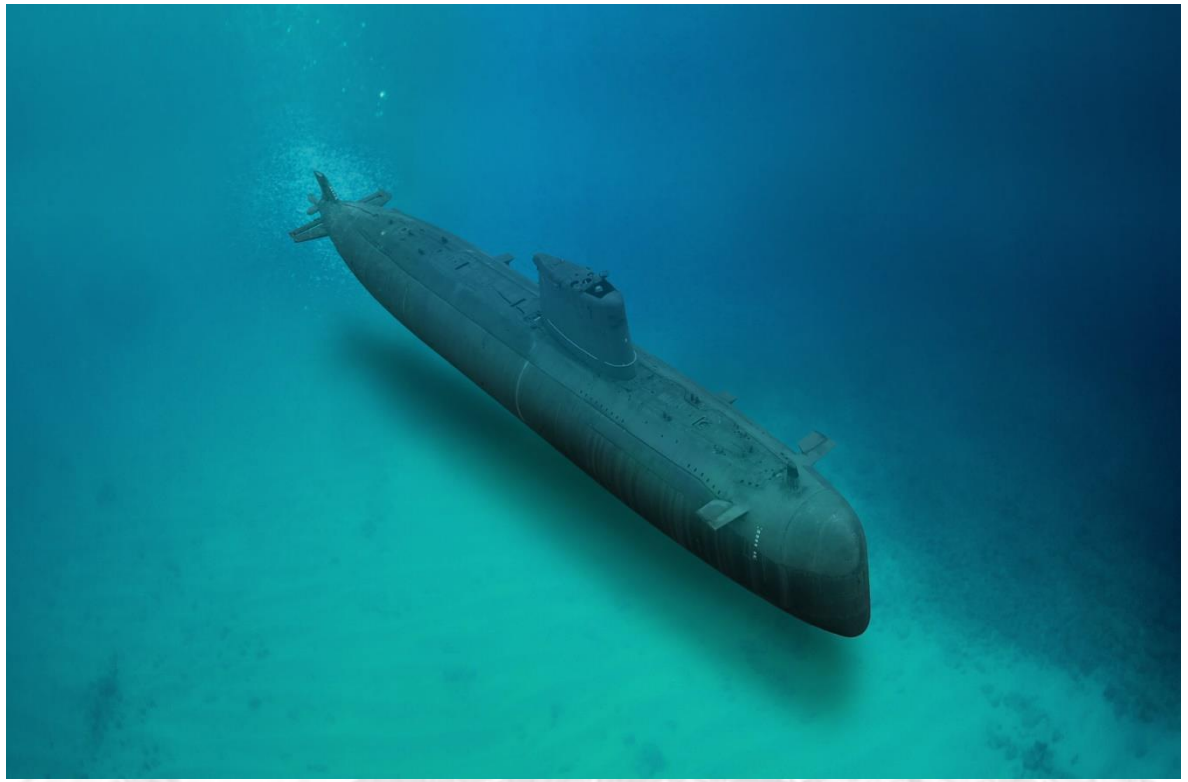
**According to the EPA:**

- Indoor air can be 2-5 times more polluted than outside air.
- On average, Americans spend 90% of their time indoors.
- Energy-efficient building without mechanical ventilation is making the problem worse.

# Why do today's homes need mechanical ventilation?

*Houses do not need to breathe (they don't have lungs) but people do!*

Yesterday's Houses



Today's Houses

# Effects of Poor Indoor Air on Humans

- Irritation of the eyes, nose, and throat.
- Headaches, dizziness, and fatigue.
- Respiratory diseases, heart disease, and cancer.
- The link between some common indoor air pollutants (e.g., radon, particle pollution, carbon monoxide, *Legionella* bacterium) and health effects is very well established.
- Radon is a known human carcinogen and is the second leading cause of lung cancer.[4, 5]

*Continued...*

U.S. Environmental Protection Agency. 1989. Report to Congress on indoor air quality: Volume 2. EPA/400/1-89/001C. Washington, DC.

# Effects of Poor Indoor Air on Humans

- Carbon monoxide is toxic, and short-term exposure to elevated carbon monoxide levels in indoor settings can be lethal.[6]
- Episodes of Legionnaires' disease, a form of pneumonia caused by exposure to the *Legionella* bacterium, have been associated with buildings with poorly maintained air conditioning or heating systems.[7, 8]
- Numerous indoor air pollutants—dust mites, mold, pet dander, environmental tobacco smoke, cockroach allergens, particulate matter, and others—are “asthma triggers,” meaning that some asthmatics might experience asthma attacks following exposure.[9]

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# What impacts indoor air quality?

# Cooking

# Day-to-Day Living

# Sources of Indoor Pollutants

**Bathroom**
Mould, mildew, odours and other microbial pathogens

**Air conditioning units**
Unable to remove pathogens, VOC's and odours
Circulates without ventilating rooms

**Living room**
Animal hair dust and dander, tobacco smoke, diesel particles, VOC's from paint, varnishes, upholstery, furniture and carpet

**Outdoor air**
Particulate matters, pathogens, VOC's, odours and emmissions

**Bedroom**
VOC's from perfumes, hairspray, nail polish, upholstery, furniture and carpet, dust mites in bedsheets

**Laundry room**
VOC's from cleaning products, mould, mildew, odours and other microbial pathogens

**Kitchen**
Cooking devices
Fuel oil

Image Source: https://www.andatechdistribution.com.au/blogs/news/indoor-air-quality-infographic

# Is Whole-House Ventilation Require by Building Codes?

*Hint – The Answer is Yes!*

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# 2015 IECC

R403.6 -- Mechanical Ventilation (Mandatory):

The building shall be provided with ventilation that meets the requirements of the International Residential Code or International Mechanical Code as applicable, or with other approved means of ventilation.

# 2015 IRC

M1507.3.3:  Mechanical Ventilation Rate-

The whole-house mechanical ventilation system shall provide outdoor air at a continuous rate of not less than that determined in accordance with Table M1507.3.3(1)

# 2015 IRC

Definition:  Whole-House Mechanical Ventilation System.

An exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air for outdoor air where operating continuously or through a programmed intermittent schedule to satisfy the whole house ventilation rate.

# Myths & Bad Arguments Against Ventilation

1. Energy Code makes me build a tight house to keep outside air out and now you want me to *purposely* bring air in?
2. I have been building houses for 30 years, never put in a ventilation system and never had a problem.
3. Exhaust ventilation won't work because the air cannot get back into the house.

# How to Ventilate Houses

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# Three Primary Types of Ventilation Strategies:

1. Exhaust Ventilation Strategy
2. Supply Ventilation Strategy
3. Balanced Ventilation Strategy

# Exhaust Ventilation Strategy

### *Methodology*

Exhausts a known quantity of stale indoor air out of the house through the continuous running fan.

Physics dictates that the same amount of air will enter the house from outside.

### *Pros & Cons*

Pros:

- Simple and affordable
- Low installation and operational costs
- Low maintenance
- Effective in Colorado's climate

Cons:

- Unknown source of new air
- Poor distribution throughout the house
- Potential backdraft atmospheric appliances
- Incoming air must be conditioned

# Supply Ventilation Strategy

## *Methodology*

It delivers outside air to the interior of the home through a ducted fan system.

It can be a stand-alone duct system or connected to the HVAC system.

The System typically has an automatic shut off for extreme temperature or humidity conditions.

## *Pros & Cons*

Pros:

- A slight positive pressure on house is better than a slight negative
- Distributed throughout the house when connected to HVAC system
- Simple and affordable installation.
- Filtration of supply air

Cons:

- Supply air can add to conditioning load
- Potential moisture issues in cold climates if indoor humidity is high enough

# Central Fan Integrated Supply

## *Methodology*

CFIS systems use the forced air duct system to deliver supply air into a house.

A duct is connected between return plenum and outside with a mechanized damper to open when the system is running.

Outdoor air is drawn into the return plenum and distributed throughout the house.

## *Pros & Cons*

Pros:

- Simple and affordable installation
- Air distributed throughout the house
- Outdoor air is filtered

Cons:

- Requires controls to ensure the air handler is running often enough to meet ventilation needs
- High electrical consumption
- Code requires furnace to have an ECM
- It is difficult to verify that ventilation needs are being met

# Balanced Strategy

*Heat and Energy Recovery Ventilators (HRV's and ERV's)*

### *Methodology*

Heat recovery and energy recovery ventilators are balanced systems; they exhaust indoor air and supply outdoor air simultaneously.

The two airstreams cross in a heat exchanger to keep the heat where it is desired.

HRV's transfer sensible heat while ERV's also transfer moisture.

### *Pros & Cons*

Pros:

- Reduces conditioning loads
- Can distribute air throughout the house
- Outdoor air can be filtered

Cons:

- Higher cost and more involved installation
- Higher maintenance

# Takeaways

- Build it tight AND ventilate it right!! (The most over-used expression in building science….but still important).
- Put it in your houses AND make sure it works.  (It's a life safety issue).
- Teach homeowners why it's there and how it works!!

# Thank you!


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EnergyLogic
Our vision: A world where all homes are efficient, healthy, and resilient.
ENERGY STAR® Sustained Excellence/Partner of the Year 2009-2014, 2016-2020

# About EnergyLogic

Berthoud, Colorado-based EnergyLogic is a software and building consulting company that has provided expert resources, education and support to new home builders and energy raters involved in the construction of high-performance homes since 2006.