ENHANCE INDOOR AIR QUALITY & REDUCE ENERGY COSTS: A CASE FOR SUSTAINABLE VENTILATION

Maximized sustainability in ventilation optimizes energy efficiency, reduces costs, supports the environment and provides cleaner and healthier indoor air

By Nick Agopian

Deficient indoor air quality (IAQ) is a problem that's threatening an increasing number of homes and buildings across the globe, especially with improved air-sealing methodologies that not only trap in air but also numerous internally generated contaminants. The best way to enhance IAQ is with more and better ventilation since fresh outdoor air can replace stale indoor air, but this can mean added equipment and energy costs.

So how can IAQ be enhanced while keeping expenses down and even generating savings? The answer is by maximizing sustainability via **energy recovery ventilation (ERV)**, a process that optimizes energy efficiency through the reuse of otherwise-wasted heat and humidity, thus reducing carbon emissions and helping to curb climate change. By recovering the energy that conventional ventilation systems discard, energy recovery ventilation can reduce HVAC energy costs by up to 40 percent every year over the long-term. Therefore, ERV systems not only further sustainability and support the environment, but they also boost the bottom line.

With that in mind, the below article lays out the case for why energy recovery ventilation is the best choice for enhancing IAQ energy-efficiently, cost-effectively and sustainably.

Energy recovery ventilation maximizes sustainability, supports the environment and boosts the bottom line

Image courtesy of Institute for Sustainability

The Situation: Deficient IAQ Threatens all Homes & Buildings

With buildings becoming increasingly air-sealed, a consequence is a rise in deficient IAQ, which is a serious—yet often unnoticed—threat to occupant health, cognitive function, productivity and general well-being. Deficient IAQ is especially concerning since people are indoors about 90 percent of the time (the elderly 95 percent) and the Environmental Protection Agency (EPA) found that indoor air may be two to five times, and occasionally greater than 100 times, more polluted than outdoor air. Hence the EPA ranks indoor air pollution among the top-five environmental risks to public health.[1] What's more, the World Health Organization (WHO) estimates that 30 percent of all new or renovated buildings suffer from deficient IAQ.[2]

A complex array of internally generated contaminants, such as toxins, vapors, gases, chemicals, odors and other Volatile Organic Compounds (VOCs), can build up and diminish IAQ. Contaminants are introduced in many ways, but the primary means is by being off-gassed from sources such as construction materials, furniture, fabrics, carpets, paints, sealants, finishes, cleaning supplies and even the human metabolic process that emits bioeffluents. A comprehensive list of indoor air contaminants, their sources and their adverse effects can be found here.

The Problem: Deficient IAQ has Many Adverse Effects & Incurs Financial Costs

Deficient IAQ has numerous adverse effects on health, cognitive function and productivity, not to mention the negative financial impact incurred by treating deficient IAQ. Below are some examples:

Adverse Effects & Financial Costs of Deficient IAQ	
Health problems	Deficient IAQ has many adverse health effects, including acute allergies, headaches, coughs, asthma, skin irritations and breathing difficulties, as well as chronic illnesses such as cancer, liver disease, kidney damage and nervous-system failure.
Cognitive impairment	Deficient IAQ causes cognitive impairment, as shown in studies by the Harvard School of Public Health and the Lawrence Berkeley National Laboratory in which Carbon Dioxide (CO2)—an indoor air contaminant—negatively impacted thinking and decision-making at levels commonly found inside all homes, schools and buildings. In fact, the Harvard study found that, on average, a typical participant's cognitive scores dropped 21 percent with a 400 ppm increase in CO2.[3] Such cognitive impairment can affect every type indoor occupant, from people inside their home, to children in daycare, to students inside K-12 schools and colleges/universities, to workers inside an office building—and everyone in between.
Productivity decline	Deficient IAQ causes serious losses in productivity for businesses of every type due to worker sickness and absenteeism, which is estimated to cost the U.S. economy $168 billion annually, according to the Building Ecology Research Group.[4]
Financial costs incurred by treating deficient IAQ	Deficient IAQ may have many adverse effects, but taking the necessary steps to enhance IAQ can incur major financial costs since new equipment must be purchased and additional energy must be expended to power the HVAC system. *You might have better IAQ, but your bottom line could be in worse shape.*

[1] All EPA facts from this paragraph are sourced from: "Why Indoor Air Quality is Important to Schools," EPA, http://www.epa.gov/iaq-schools/why-indoor-air-quality-important-schools.

[2] "Indoor Air Pollution: Introduction for Health Professionals," U.S. Consumer Product Safety Commission, http://www.cpsc.gov/en/Safety-Education/Safety-Guides/Home/Indoor-Air-Pollution-Introduction-for-Health-Professionals/.

[3] Joe Romm, "Exclusive: Elevated CO2 Levels Directly Affect Human Cognition, New Harvard Study Shows," Climate Progress, October 26, 2015, http://thinkprogress.org/climate/2015/10/26/3714853/carbon-dioxide-impair-brain/.

[4] Hal Levin, "Commercial Building Indoor Air Quality: Introduction to the Problem," Building Ecology, November 1999, http://www.buildingecology.com/articles/commercial-building-indoor-air-quality-introduction-to-the-problem/.

The Solution: Energy Recovery Ventilation Enhances IAQ & Reduces Costs by Maximizing Sustainability

What's the best way to provide cleaner and healthier air inside homes and buildings? The answer is more and better ventilation. As long as enough controlled fresh outdoor air is coming in and stale indoor is exhausted out, indoor environments will enjoy high-quality air. In fact, the American Lung Association states that proper ventilation is essential for keeping the air fresh and healthy indoors.[5]

So how can IAQ be enhanced while also minimizing costs and even generating savings? The best way is via energy recovery ventilation, which enhances IAQ while maximizing sustainability. This is achieved through optimizing energy efficiency by capturing otherwise-wasted heat and humidity from the exhaust air that's then used to precondition the outdoor coming in. This leads to a substantial reduction in equipment and energy costs, thus spurring the EPA to state that, "Energy recovery ventilation systems provide excellent opportunities for saving energy, controlling humidity and providing sufficient outside air to promote IAQ."[6]

How does energy recovery ventilation maximize sustainability? There are three main ways:

How Energy Recovery Ventilation Maximizes Sustainability	
Optimized energy efficiency	Energy efficiency is optimized by preconditioning the outside air coming in with the otherwise-wasted heat and humidity of the exhaust air going out. During the warmer months, outside air entering a home or building is pre-cooled and dehumidified, while in the cooler months, the outside air entering a space is humidified and pre-heated. This results in HVAC energy costs being reduced by up to 40 percent.
Reduced HVAC loads	Because less energy is used in the ventilation process, the loads that HVAC systems use to power heating and cooling can be drastically reduced, resulting in even further reductions in HVAC energy use and costs, as well as capital equipment downsizing.
Minimized carbon footprints	The combination of less energy used and HVAC loads being reduced means carbon footprints are minimized, thus supporting the environment and helping to curb climate change.

By maximizing sustainability in the ventilation process, energy recovery ventilation has many benefits, including:

Benefits of Energy Recovery Ventilation	
Cleaner and healthier indoor air	IAQ is enhanced since internally generated contaminants are removed by exhausting stale indoor air, while outdoor contaminants are prevented from entering through filtration.
HVAC energy costs are decreased by up to 40%	This is possible by optimizing energy efficiency, cutting peak demand, streamlining operations and reducing HVAC loads.
Significant annual long-term energy savings	Due to optimized energy efficiency and reduced HVAC loads every year for the life of the system, significant annual energy savings are generated over the long-term.
Increased structural asset value and longevity	When a home or building suffers from deficient IAQ, not only are indoor occupants feeling the adverse effects, but a poor indoor environment also produces a diverse assortment of potentially negative impacts on the asset value and longevity of the structure. For example, the growth of microbiological organisms might be encouraged, mold might be more apt to propagate, upkeep and maintenance demands could increase and premature construction-material failure could be more common, just to name a few damaging scenarios. Enhanced IAQ improves the overall health and integrity of the actual structure, thus increasing its asset value and longevity.
Lowered capital & operating costs	By downsizing HVAC equipment and streamlining operations, a home or building's capital and overall operating costs are lowered.
Bolstered building revenue potential	By advancing occupant health, cognitive function, productivity and comfort with enhanced IAQ, a building can charge more in rent due to offering these benefits that other buildings can't provide, thus bolstering monthly lease potential and expanding overall revenue. Additionally, by reducing energy, capital and operating costs, building operating profits can be further increased.
Strengthened sustainability	Less HVAC energy used means a reduced carbon footprint, which strengthens sustainability efforts.

That said, not all ERV systems are created equal. The best option is RenewAire's high-efficiency, enthalpic-core, static-plate ERV systems, which utilize a static-core technology unlike any other company to recover total energy, and not just sensible energy. RenewAire was the first to manufacture static-core ERV technology in North America over 30 years ago, and the systems are known for their ease of use, reliability and energy savings. When compared to other ERV options, here are the reasons why RenewAire is the best choice:

Why RenewAire is the Best Choice for Energy Recovery Ventilation	
Strong track record of quality	RenewAire was the first company to manufacture static-core ERV technology in North America over 30 years ago.
Easy and simple	System installation and use is easy and straightforward, and maintenance is simple and minimal.
Ultimate reliability	Static cores are the most reliable form of ERV technology in the industry and rarely ever break down.
Amplified annual long-term energy savings	Due to unparalleled reliability and efficiency, annual energy savings are amplified over the long-term.
Built to last	The systems are built to last for over 20 years, and deliver significant energy savings every year over their lifetime.

[5] "Ventilation: How Buildings Breathe," American Lung Association, http://www.lung.org/our-initiatives/healthy-air/indoor/at-home/ventilation-buildings-breathe.html.

[6] "Indoor Air Quality and Energy Efficiency," U.S. Environmental Protection Agency (EPA), https://www.epa.gov/indoor-air-quality-iaq/indoor-air-quality-and-energy-efficiency.

Why RenewAire is the Best Choice for Energy Recovery Ventilation	
Competitively priced	Costs are kept low through unparalleled innovative design practices, expert workmanship and a Quick Response Manufacturing (QRM) process, thus enabling all units to be competitively priced.
Short payback	Due to significant energy savings and competitive pricing, the payback period is short.
Recoup upfront costs quickly	Due to low-priced units, a short payback and major energy savings, upfront costs can be recouped quickly.
Relevant everywhere	Units are designed with flexibility in mind to support a wide array of home and building sizes, types and installation constraints. All climates are supported, from the coldest, driest conditions in Alaska, to the hottest, most humid extremes in Florida.
Best warranty and lowest claims	RenewAire offers an industry-leading 10-year warranty on the static core, and the company's warranty-claim track record is the lowest in the industry.
No defrosting necessary	No condensate pans or drains are used so there's no need to defrost, thus making maintenance even easier.
No cross-contamination of airstreams	Exhaust and fresh outdoor airstreams are kept completely separate to prevent airstream cross-contamination. Units are AHRI 1060-certified at zero percent cross-contamination with balanced airflow.
Highly rated	RenewAire has some of the highest ratings in the industry from such top organizations as the Home Ventilating Institute (HVI) and the Air-Conditioning, Heating and Refrigeration Institute (AHRI).
Qualify for top-level certifications and rebates	Homes and buildings can qualify for energy-efficiency and sustainability certifications from such renowned organizations as: LEED, Green Globes, Passive House, Living Building Challenge, DOE/ENERGY STAR and Net Zero Buildings. Rebates can also be attained due to reductions in the consumption of HVAC energy.
Exceptional indoor comfort	Temperatures and humidity are moderated to maintain a comfortable indoor environment.
Superior customer service and support	The knowledgeable RenewAire customer-service and support team is ready to answer any type of question.

The Results: Better Savings, Health, Cognitive Function, Productivity, Comfort & Well-Being
By enhancing IAQ while maximizing sustainability through energy recovery ventilation, the following results are achieved:

Results of Enhanced IAQ Achieved by Maximizing Sustainability via Energy Recovery Ventilation	
A better bottom line	Due to reduced HVAC energy consumption, as well as equipment downsizing, the result is significant energy savings every year over the long-term. For example, cutting HVAC energy costs by up to 40 percent every year for the life of the system—which is built to last for over 25 years—equals serious energy savings.
Improved health	By breathing cleaner and healthier indoor air day and night on a consistent basis, occupants will experience fewer short- and long-term health problems, which is an important achievement considering the WHO determined that in 2012, 4.3 million deaths globally were attributable to household air pollution.[7]
Heightened cognitive function	By removing contaminants from the indoor air, occupants will improve their overall cognitive function, thus achieving more coherent thinking and decision-making. Specifically, the same Harvard study mentioned previously found that, on average, when compared to an indoor environment with deficient IAQ (high VOC concentration), cognitive scores were 61 percent higher in a simulated green-building environment (low VOC concentration) and 101 percent higher in a simulated green-building environment coupled with doubling the outdoor-air ventilation rate from 20 CFM per person to 40 CFM per person.[8]
Boosted productivity	Higher-quality indoor air results in healthier workers, thus reducing sickness and absenteeism. In addition to better health, workers will also experience improved cognitive function, thus further boosting productivity. In fact, another Harvard study found that doubling the rate of a conventional ventilation system from 20 CFM per person (the rate recommended by ASHRAE) to 40 CFM per person only costs about $32 per person, per year and leads to a productivity increase of $6,500 per person, per year. And if an ERV system is added, the anticipated increase in energy costs can be reduced by 60 percent.[9]
Exceptional indoor comfort	By moderating indoor temperatures and humidity, a comfortable indoor environment is achieved.
Enriched lives and well-being	A better bottom line, improved health, enhanced cognitive function and boosted productivity all add up to enriched lives and well-being for indoor occupants, which is accomplished energy-efficiently, cost-effectively and sustainably.

In Sum
Deficient IAQ threatens all homes and buildings, especially with air-sealing integrity on the rise, and this poses serious risks to the health, cognitive function, productivity and well-being of indoor occupants. However, enhancing IAQ can incur additional costs in terms of new equipment purchases and further energy expended by the HVAC system. The solution to enhancing IAQ cost-effectively is energy

[7] "Burden of disease from ambient and household air pollution," World Health Organization (WHO), http://www.who.int/phe/health_topics/outdoorair/databases/en/.

[8] Joseph G. Allen, Piers MacNaughton, Usha Satish, Suresh Santanam, Jose Vallarino and John D. Spengler, "Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments," Environmental Health Perspectives, October 26, 2015, http://ehp.niehs.nih.gov/wp-content/uploads/advpub/2015/10/ehp.1510037.acco.pdf.

[9] Piers MacNaughton, James Pegues, Usha Satish, Suresh Santanam, John Spengler and Joseph Allen, "Economic, Environmental and Health Implications of Enhanced Ventilation in Office Buildings," International Journal of Environmental Research and Public Health, November 18, 2005, http://www.mdpi.com/1660-4601/12/11/14709/html.

recovery ventilation, which provides cleaner and healthier indoor air while at the same time reducing energy costs and even generating significant long-term energy savings—all of which is possible by maximizing sustainability.

To learn more about how energy recovery ventilation can enhance IAQ energy-efficiently, cost-effectively and sustainably in your home or building, contact RenewAire today by clicking here.

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