tech primer

Enhanced Ventilation with Energy Recovery Ventilators (ERV)

Mechanical ventilation optimization for improved comfort and savings.

tech overview

applicable building types
all types

implementation
at refinance

fast facts
- reduces GHG emissions
- improves air quality
- reduces heating and cooling loads
- reduces utility costs

costs & benefits*

GHG Savings

Tenant Experience Improvements

Utility Savings

Capital Costs

Maintenance Requirements

*ratings are based on system end use, see back cover for details.

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getting to know enhanced ventilation and ERVs

An enhanced mechanical ventilation system with an Energy Recovery Ventilator (ERV) provides controlled and conditioned ventilation that improves indoor air quality and occupant health, while reducing greenhouse gas emissions and saving energy.

how do enhanced ventilation and ERVs work?

Fresh, clean air supports human health and is critical to indoor air quality and comfort. Buildings that adopt enhanced ventilation strategies are less likely to experience persistent odors, mold, dampness, and other issues that trigger complaints and increase health risks.

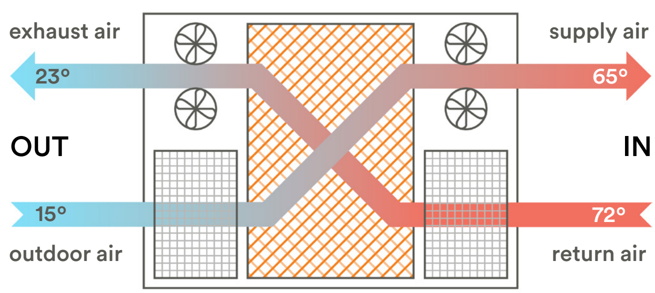
Many buildings have a mechanical ventilation system that uses fans to pull stale air out of the building and bring fresh outdoor air into the building. Outdoor air is filtered to remove pollutants before it is heated or cooled (if integrated into a traditional HVAC system), and circulated throughout the building.

Mechanical ventilation systems require regular maintenance to ensure efficient operation, including cleaning and sealing air ducts as well as balancing airflow. Additional equipment can optimize energy savings, such as speed-controlled fans and Energy Recovery Ventilators (ERVs). See our *Dedicated Outdoor Air System and Energy Recovery Ventilators Tech Primer* for other ERV applications.

An ERV is a type of heat exchanger that either pre-heats or pre-cools incoming outdoor air, significantly reducing the demand on heating and cooling equipment. ERVs work by transferring heat contained in exhausted (indoor) air to incoming (outdoor) air or vice versa, depending on the season (see Fig 1). The two air streams do not mix, keeping odor and pollutants in exhausted air separate from fresh supply air. This technique, called preconditioning, conserves energy that would otherwise be lost with traditional ventilation methods.

This tech primer outlines a high performance retrofit for mechanical ventilation systems that include enhanced ventilation strategies to maximize energy savings and indoor air quality.

Fig 1. During winter, heat from the return air is transferred to the supply air in the ERV's heat recovery core (orange hatch). The system reverses in summer, where heat from the outdoor air is transferred to the exhaust air, helping to cool the supply air.



Assess
Always consult a qualified service provider before undertaking any building upgrades.

Coordinate Upgrades for Maximum Savings
Implementing a ventilation retrofit in conjunction with building envelope improvements that reduce air leaks and infiltration can improve the performance of the ventilation system.

Establish a tight building envelope through general air sealing, window upgrades, insulation improvements.

Buildings Without Mechanical Ventilation
Buildings without mechanical ventilation systems can install smaller, unitized ERVs in each apartment or unit that vents directly to the outside through the exterior wall.

Options range from single module products to multi-ERV systems that coordinate multiple ERVs to maximize heat recovery.

how to enhance mechanical ventilation systems

A high-performance retrofit typically includes cleaning and sealing ductwork, balancing airflow, upgrading fans with speed controls, and installing ERVs.

retrofit solutions

Mechanical ventilation systems are comprised of a number of components that should each be addressed when completing a high performance retrofit.

A Clean and Seal Ducts– Dust, dirt, and grime accumulate inside air ducts, inhibiting airflow and depositing dust particles inside the building. Holes or gaps in ducts further inhibit airflow and create inconsistent air distribution. Cleaning and sealing ductwork is an effective solution that improves airflow and indoor air quality.

- Conduct a video camera inspection to find holes in ductwork.
- Seal large holes in ducts with mastic and small holes with an aerosol sealant.
- For gypsum duct systems, sealing large holes may require cutting into the wall for direct repair.
- Adjust ventilation rates after cleaning and sealing ducts to reflect the improved airflow.

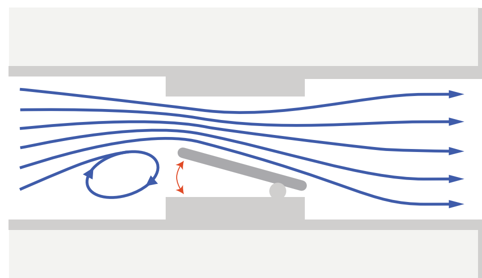
Photo: Steven Winter Associates

View into a dusty, grimy air duct.

B Balance Airflow– Inconsistent ventilation across a building can be improved by installing Constant Airflow Regulator (CAR) dampers to balance and regulate airflow (see Fig. 2). These devices incorporate an inflatable bulb or "airplane wing" mechanism that restricts air at higher pressures, resulting in consistent airflow across different pressure rates.

- Duct operating pressures are typically between 0.2 and 0.8 inches water gauge (in.w.g.). The minimum operating pressure of 0.2 in.w.g. requires tight ducts and roof fans capable of providing sufficiently high pressure.

Fig 2. A Constant Airflow Regulator (CAR) automatically dampers airflow to achieve consistent ventilation.



C Install Direct-Drive Fans– Replace existing rooftop exhaust fans with direct-drive fans that have motor speed controllers.

- Size fans based on code requirements plus a margin for any small air leaks remaining after sealing.
- Adjust the speed controller at each fan based on the pressure requirements of the system.

D Install Energy Recovery Ventilators (ERVs)– The current energy code requires ERVs to supply common area ventilation, however to fully maximize energy savings, install an ERV system that also supplies air to individual spaces.

- ERVs are required for buildings that supply 100% outdoor air.
- Ensure that the ventilation system is balanced before installing ERVs.
- ERVs can be installed as a centralized system or as a unitized system with ERVs installed in each individual space.

costs & benefits of enhanced ventilation*

Greenhouse Gas (GHG) Savings

A high performance ventilation retrofit can reduce heating and cooling related GHG emissions, depending on pre-retrofit conditions and other building systems.

Tenant Experience Improvements

A high performance ventilation retrofit can greatly increase tenant experience by effectively removing stale, contaminated air and delivering fresh, clean air to support occupant health and well-being.

Utility Savings

A small amount of utility savings can be achieved through the reduction of heating and cooling loads inherent in Energy Recovery Ventilation.

Capital Costs

A large capital investment is required for a ventilation retrofit that includes cleaning and sealing ducts, balancing air flow, and installing ERVs. Consider implementing this scope at the time of window replacement or a building envelope retrofit.

Maintenance Requirements

Mechanical ventilation systems and ERVs require a low level of maintenance. Inspecting ventilation risers, vents, and equipment is critical to efficient operation. Regular cleaning of the ventilation system will keep air flowing smoothly. ERVs should typically be inspected every 3 months, and air filters need to be replaced regularly to maintain optimal performance.

**The Costs & Benefits rating system is based on a qualitative 1 to 4 scale where 1 () is lowest and 4 () is highest. Green correlates to savings and improvements, orange correlates to costs and requirements. Ratings are determined by industry experts and calculated relative to the system end use, not the whole building.*

Note: Existing ventilation assumed to be exhaust only. Savings are based on heating and cooling usage.

Take Action

This document is one of more than a dozen High Performance Technology Primers prepared by Building Energy Exchange and the NYC Accelerator to introduce decision-makers to solutions that can help them save energy and improve comfort in their buildings. Access the complete library of Tech Primers here:

be-exchange.org/tech-primers

NYC Accelerator is a City program that helps New Yorkers implement building energy and water efficiency upgrades to reduce carbon emissions. The NYC Accelerator provides free, individualized support for building decisionmakers to cut operating costs, meet local law compliance, access financing and boost building performance. NYC Accelerator is here to help you navigate the complexities related to local energy laws so your buildings, and our city, are more livable for all.

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The Building Energy Exchange (BE-Ex) is a center of excellence dedicated to reducing the effects of climate change by improving the built environment. BE-Ex accelerates the transition to healthy, comfortable, and energy efficient buildings by serving as a resource and trusted expert to the building industry.

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