tech primer

Enhanced Ventilation with Energy Recovery Ventilators (ERV)

Mechanical ventilation optimization for improved comfort and savings.

tech overview

applicable building types
all types

when to implement
refinancing

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.

be ex STL

getting to know enhanced ventilation with 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 does enhanced ventilation with ERVs work?

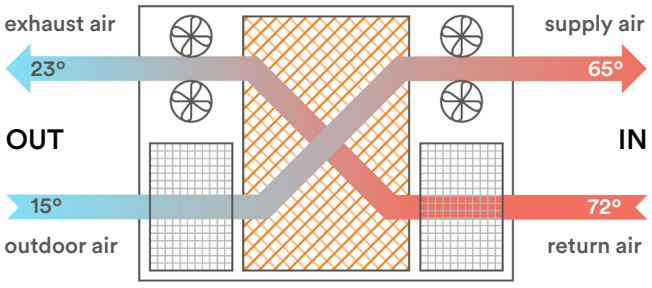
Fresh, clean air supports human health and is critical to indoor air quality and comfort. Buildings that adopt enhanced ventilation strategies are less likely to experience persistent odors, mold, dampness, and other issues that trigger complaints and increase health risks.

Many buildings have mechanical ventilation systems that use fans to pull stale air out of the building and bring in fresh outdoor air. If integrated into a traditional HVAC system, mechanical ventilation systems filter outdoor air to remove pollutants before heating or cooling the air and then circulating it throughout the building. These systems require regular maintenance to ensure efficient operation, including cleaning and airsealing ducts, and balancing airflow.

Additional equipment can be installed to increase ventilation system energy savings, such as speed-controlled fans and automated balancing dampers. Energy Recovery Ventilators (ERVs) offer a high-performance option to further maximize energy savings and indoor air quality.

An ERV is a type of heat exchanger that either pre-heats or pre-cools incoming outdoor air, significantly reducing 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). This heat exchange occurs via a membrane, so the two air streams never touch, preventing pollutants in the outgoing exhaust air from mixing with the fresh supply air. This technique, called preconditioning, conserves energy that would otherwise be lost with traditional ventilation methods.

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, when heat from incoming outdoor air is transferred to outgoing exhaust air, helping to cool down the supply air.



Energy Recovery Ventilator

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

Coordinate to Maximize Savings
Implementing a ventilation retrofit in conjunction with building envelope improvements that reduce air leaks and infiltration can improve ventilation system performance.

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

Buildings Without Mechanical Ventilation
Buildings without mechanical systems can install smaller, unitized ERVs in each occupant space that vent directly to the outside via the exterior wall or a dedicated duct run.

Options range from single module products to multi-ERV systems that coordinate to maximize savings.

A high-performance ventilation system 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 several components that should all be addressed as part of a high performance retrofit.

A Clean and Seal Ducts: Dust, dirt, and grime accumulate inside air ducts over time, inhibiting airflow and depositing dust in occupant spaces. 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 walls for direct repair.
- Adjust ventilation rates after cleaning and sealing ducts to reflect the improved airflow.

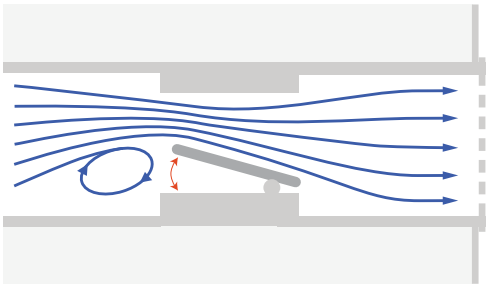
Photo: Steven Winter Associates

Air ducts accumulate dust and grime over time.

B Balance Airflow: Improve inconsistent ventilation 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, 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 maintain consistent ventilation rates.



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 to account for any small air leaks that may remain after duct sealing.
- Adjust the speed controller at each fan based on the pressure requirements of the system.

D Install Energy Recovery Ventilators (ERVs): 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 that serves an entire building, a unitized system with ERVs serving individual space, or a semi-decentralized system with a few ERVs serving various zones of a building.

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 its partners to introduce decision-makers to solutions that can help them save energy and improve comfort in their buildings. Access the complete Tech Primer library: **be-exstl.org/building-blocks**

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The Building Energy Exchange (BE-Ex), located in New York City, has served as a trusted resource for the real estate, design, and construction industries for over a decade. BE-Ex supports the growth of centers of excellence across the country dedicated to reducing the effects of climate change by improving the built environment.

Launched in Spring 2021, BE-Ex STL will utilize the deep resources and expertise of BE-Ex in New York, while also creating a customized approach to services and programs in our city.

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