

# ENGINEERING REPORT

## TOPIC: Why Install An ERV?

Report No. R0001

By Tony Moffett

### Compelling Evidence for ERV's

The most obvious reason to install an ERV is to recover energy when there is a fresh air requirement. When fresh air is brought into a building there is conditioned air exhausted back outside to equalize the pressure. The air leaving a building has energy in it - either warm energy in the winter or cool energy in the summer. An ERV allows you to capture 70% of the energy from the air leaving the building and put it back into the fresh air entering the building. This recapturing of energy means your rooftop unit does not have to work as hard and pays you back through lower monthly utility bills. The rooftop unit may also be sized smaller since it does not have to work as hard.

What are some other reasons to install an ERV? Workplace and school environments can have a high concentration of people and need plenty of fresh air. Adding fresh air lowers the CO<sub>2</sub> levels in a building and helps to keep the occupants alert and healthy. ERV's also help to control odors since stale air is exhausted out of the building as fresh air is brought in. How about humidity? ERV's are effective at managing humidity by keeping moist air inside in the winter and outside in the summer.

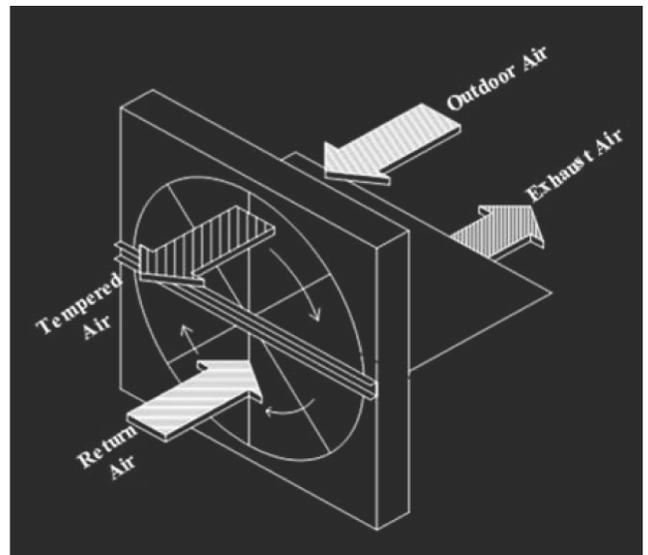
ERV's can be critical for school jobs to comply with ASHRAE 90.1. Generally, you must bring in 15 CFM per student and must have at least 50% recovery on all systems with 5,000+ CFM and 70%+ outside air. The first check would be if 5,000+ CFM is being moved through the HVAC system. If it is, then the next step would be to divide your total CFM by the outside air to find out if you are bringing in at least 70% outside air.

For example, a local school has an 8,000 CFM HVAC system and 400 students. Here are the steps to determine if 50% recovery is required:

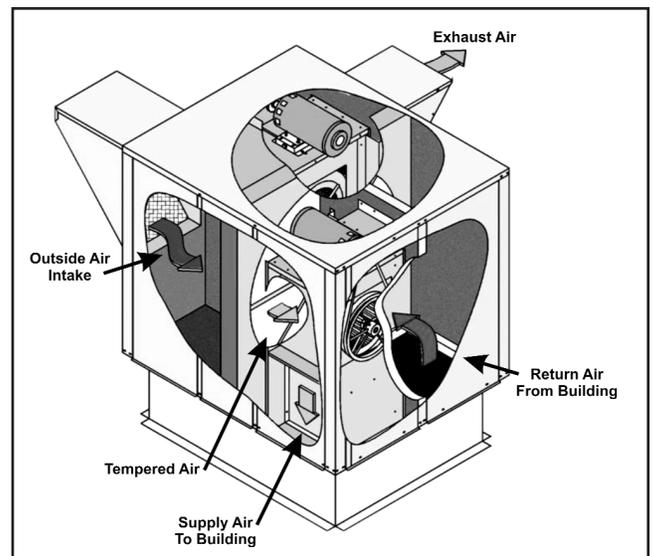
- The HVAC system delivers 8,000 CFM so it is over the 5,000 CFM minimum.
- 400 students require 6,000 CFM of fresh air (400 x 15 CFM = 6,000 CFM)
- $6,000 \text{ CFM} / 8,000 \text{ CFM} = 75\%$

In this case the school's HVAC system must bring in over 70% of outside air so some type of recovery is required. ERV's from Ruskin and Ruskin Rooftop

Systems achieve well over the 50% recovery required by ASHRAE 90.1. Jim Connell, Vice President Sales at Airxchange, says, "Adding Energy Recovery Ventilators to school projects has nearly a 100% hit rate due to the energy efficiencies and cost savings gained."



Energy Exchange Process



ERV in Action

## Other Recommended Ventilation Rates per ASHRAE 62-89

Application	Ventilation Rate per Person
Office space	20 cfm
Restaurants	20 cfm
Bars/Cocktail	30 cfm
Hotel Rooms	30 cfm/room
Conference Rooms	20 cfm
Hospital Rooms	25 cfm
Operating Rooms	30 cfm

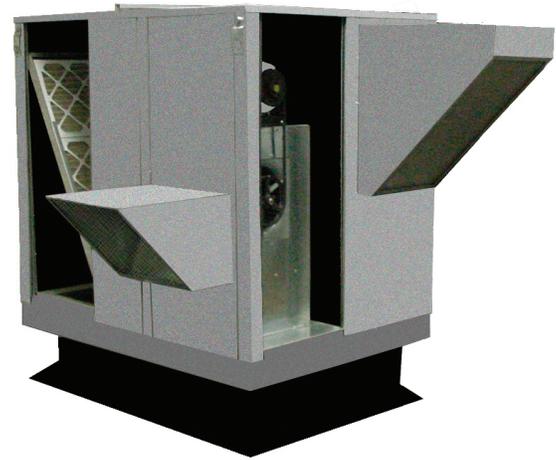
Application	Ventilation Rate per Person
Smoking	60 cfm
Beauty Salon	25 cfm
Supermarkets	15 cfm
Auditorium	15 cfm
Classrooms	15 cfm
Laboratory	20 cfm
General Retail	15 cfm

## Let's Look at Some Examples:

**Scenario 1:** Your calculations show a new job in Florida requires a 15 ton rooftop unit which is circulating approximately 6,000 CFM. There is a 35% outside air requirement so you are bringing in 2,100 CFM of fresh air. So is an ERV required? It is not "required," however, it is still a good decision to install because you can downsize the 15 ton rooftop to a 12 ton unit and apply the savings to the purchase of an ERV. When sized properly you can pay back the initial cost of an ERV in less than one year.

**Scenario 2:** You are planning on a new installation where there will be no outside air brought in. Should an ERV be considered for the HVAC system? No, there is no reason for an ERV if you are not bringing in outside air.

**Scenario 3:** A local school is being renovated and will typically occupy 2,000 students. Four new 25 ton rooftop units are being planned for with a total of 40,000 CFM with 30,000 CFM of fresh air. As the 30,000 CFM is brought into the building there will be 30,000 CFM exhausted back outside to equalize the pressure. According to ASHRAE 90.1, we need to recover 50% of the energy being exhausted in the 30,000 CFM. An ERV would be perfect for this application since it would recover well over 50% of the energy and provide long term utility bill savings.



Typical ERV

## A Closer Look at ERV Economics:

### Example #1: 20 Ton HVAC System with 25% Outside Air - Miami

#### Rooftop System with ERV

Cost of 15 Ton DX System	\$15,000
Cost of ERV (5 tons)	\$6,000
Rebate on ERV	(\$2,000)
<b>Total Up-front Cost</b>	<b>\$19,000</b>
Yearly Operating Savings - 12x5	\$1,330
<b>Lifetime Savings (15 Years)</b>	<b>\$19,950</b>

#### Rooftop System without ERV

Cost of 20 Ton DX System	\$20,000
Cost of ERV	\$0
Rebate on ERV	\$0
<b>Total Up-front Cost</b>	<b>\$20,000</b>
Yearly Operating Savings - 12x5	\$0
<b>Lifetime Savings (15 Years)</b>	<b>\$0</b>

## Example #2: 20 Ton HVAC System with 25% Outside Air - Milwaukee

### Building HVAC System with ERV

Cost of 15 Ton DX System	\$15,000
Cost of ERV (5 tons)	\$6,000
Rebate on ERV	(\$2,500)
<b>Total Up-front Cost</b>	<b>\$18,500</b>
Yearly Operating Savings - 12x5	\$1,883
<b>Lifetime Savings (15 Years)</b>	<b>\$28,245</b>

### Building HVAC System without ERV

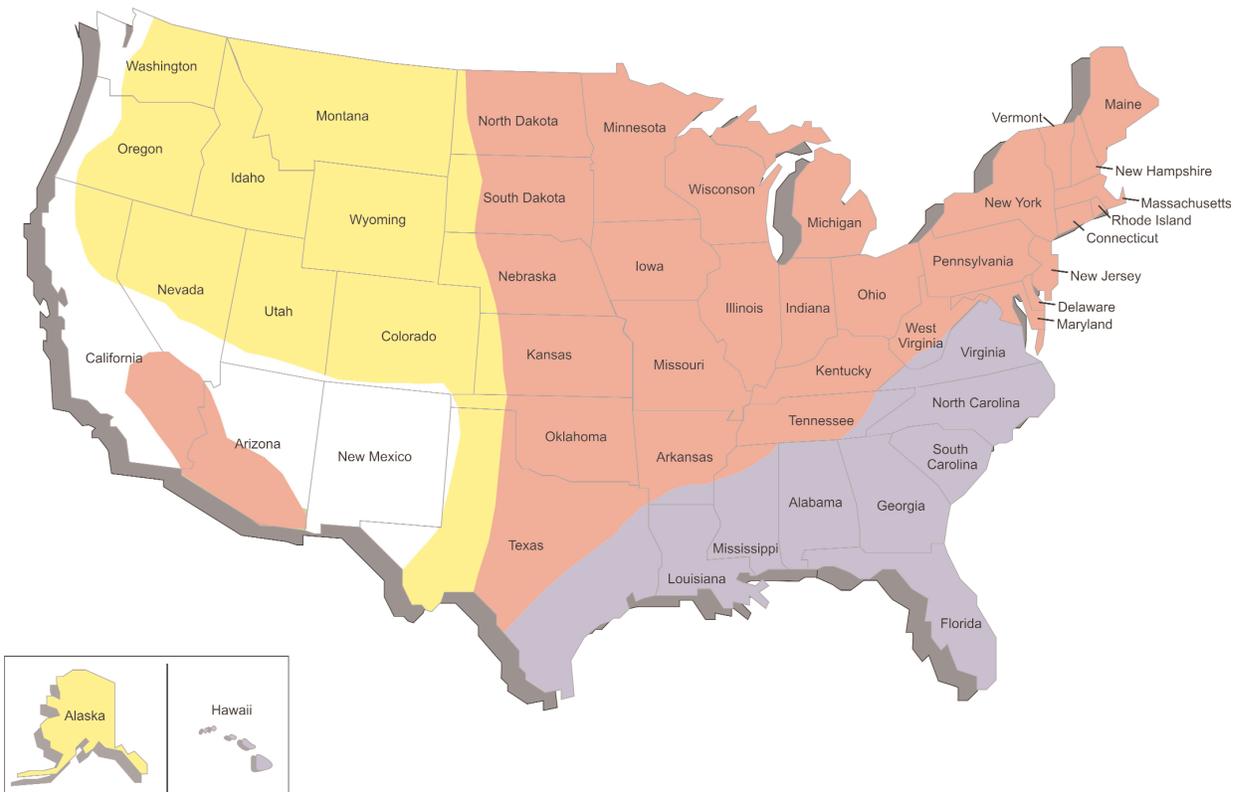
Cost of 20 Ton DX System	\$20,000
Cost of ERV	\$0
Rebate on ERV	\$0
<b>Total Up-front Cost</b>	<b>\$20,000</b>
Yearly Operating Savings - 12x5	\$0
<b>Lifetime Savings (15 Years)</b>	<b>\$0</b>

Examples above assume \$1000 per ton, \$3 per cfm for energy recovery, \$1 per therm, \$.08 kWh, 2000 cfm outdoor air.  
Source: Airxchange

What kind of software is available for sizing of ERV's and rooftop units? Ruskin and Ruskin Rooftop Systems have free downloadable software at [www.rooftopsystems.com](http://www.rooftopsystems.com). This program helps you properly size your rooftop unit and ERV, then even helps you calculate the energy savings. The EPA also offers software called SAVES (School Advanced Ventilation Engineering Software). SAVES helps by showing energy savings when using Energy Recovery Ventilation (ERV) systems for school applications. Go to <http://www.epa.gov/iaq/schooldesign/saves.html> for more information.

### Regional Payback

- Total-Recovery or Sensible-Only-Recovery ERV Systems Recommended  
Total-Recovery Payback Typically 0 to 2 Years  
Sensible-Only-Recovery Payback Typically 2 to 7 Years
- Total-Recovery ERV Systems Recommended  
Total-Recovery Payback Typically Immediate
- Total-Recovery or Sensible-Only-Recovery ERV Systems Recommended  
Payback for Both Configurations Typically 2 to 7 Years



Source: [www.epa.gov](http://www.epa.gov)

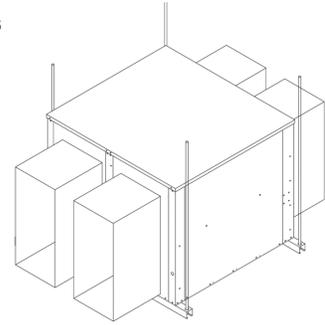
## ERV's for Retrofit

Ruskin and Ruskin Rooftop Systems offer the perfect ERV's for retrofit applications. There are no roof curbs required and no holes to cut in your roof. "M" and "N" Series Indoor ERV's are designed to mount in mechanical rooms or in ceiling duct work and can be suspended or slab mounted. The beauty of these indoor ERV's is that you can upgrade the energy efficiency of your building quickly and easily by adding to existing duct systems.

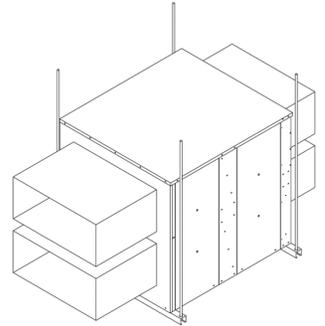
**"M" Series** energy recovery ventilators are designed for use inside a building for applications that require "side-by-side" duct. Typically these units are installed in a mechanical room or mounted above a ceiling. Both the outside air intake and the exhaust air have duct systems to an outside source. The return air and supply air also are ducted. Balancing dampers should be utilized to help control the air volumes.

**"N" Series** energy recovery ventilators are designed for use inside a building for applications that require "over and under" duct. Typically these units are installed in a mechanical room or mounted above a ceiling. Both the outside air intake and the exhaust air have duct systems to an outside source. The return air and supply air also are ducted. The horizontal return duct connection can be converted to bottom return in the field. Balancing dampers should be utilized to help control the air volumes.

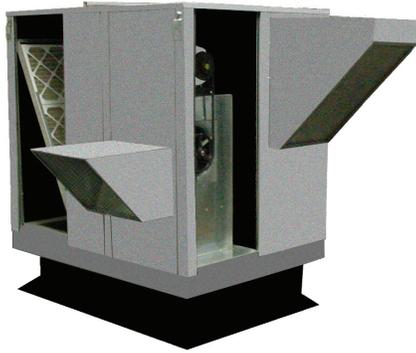
**"M" Series**



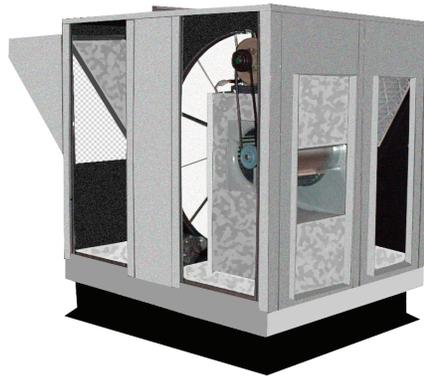
**"N" Series**



## Outdoor ERV's



**"D" Series** energy recovery ventilators are utilized in applications that require a rooftop installation. These units may be installed as a stand-alone unit with a separate and distinct duct system from other air conditioning equipment. In many applications the supply (intake) air duct is connected to the return air duct of an air conditioning system (or multiple systems). By doing this the enthalpy wheel is able to provide preconditioned outside air to the air conditioning system(s).



**"S" Series** energy recovery ventilators are designed for outside use in rooftop or "pad" installations where the application requires a "side-by-side" duct system. One of the benefits of this design is the ability to easily be connected to the horizontal ductwork of an air conditioning system. Balancing dampers should be utilized to help control the air volumes.



**"O" Series** energy recovery ventilators are designed for outside use in rooftop or "pad" installations where the application requires an "over and under" duct system. One of the benefits of this design is the ability to be ducted directly to the back of a rooftop air conditioning unit. Another use is for "through the wall" applications. The horizontal return duct connection can be converted to bottom return in the field. Balancing dampers should be utilized to help control the air volumes.

See Ruskin Case Study CS-1200 "South High Community School" for related information.

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