ZECO
We breathe air into your life

Healthy Buildings Through De-carbonization and De-contamination

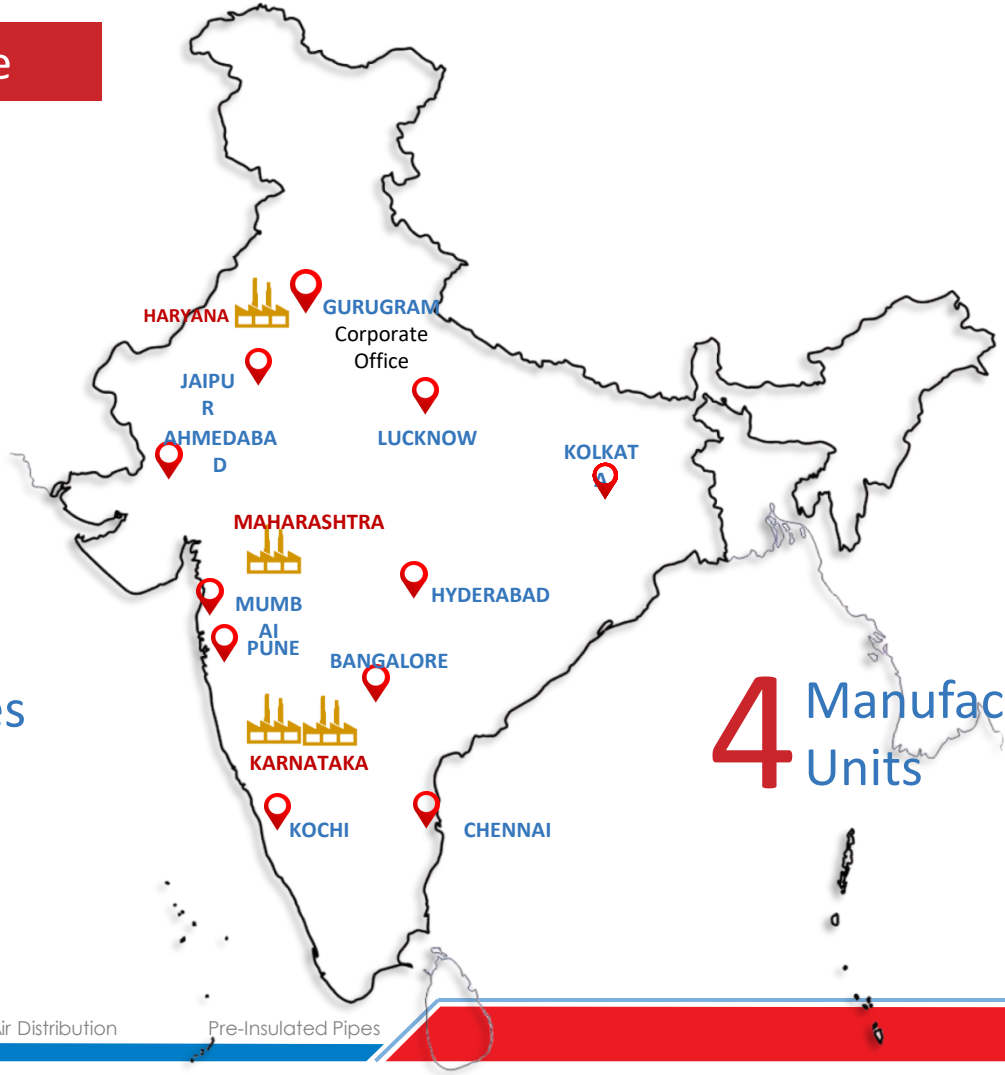
Dedicated Clean Air System
&
Dedicated Clean Air Module

Corporate Highlights

Corporate Office	Gurugram, India **Corporate Video**
Glorious History	Zeco Aircon came into existence in 1989 – nearly 3 decades of presence
Vision	To be the world leader in air management solutions by providing high-quality products with the best service support and be the most admirable company to work within the industry by way of sustainable profitable growth.
Mission	To continuously improve the quality standards of our products, delivery and services that we offer to our customers and strive for customer delight.
Human Resource	Dedicated team of over 1000+ professionals
Customer Base	Well diversified and varied portfolio of over 10,000+ customers
Infrastructure	4 Manufacturing Plants, 10 Regional Offices
FY 23 Turnover	INR 400 Crores
FY 23 No's	72,000 Units (AHU/FCU/TFA/Air Washers), 3.2 Million M^2 Air Distribution Panels & Ducts, 2.4 Million FT of Coils, 10 Million M^2 of Pre-Insulated Pipes
Customer Segments	Residential & Commercial Buildings, Airports, Railways, Warehouses, Hospitals, Shopping Malls, Government Facilities etc.
Priorities	•Customer centric organisation •Attracting, Retaining developing best Talent •Optimum utilization of all resources •Increase market reach & consultant mapping – capture every inquiry •Ensuring growth with profitability

India Presence

ZECO
We breathe air into your life



10
Technical Sales & Support Offices

4 Manufacturing Units

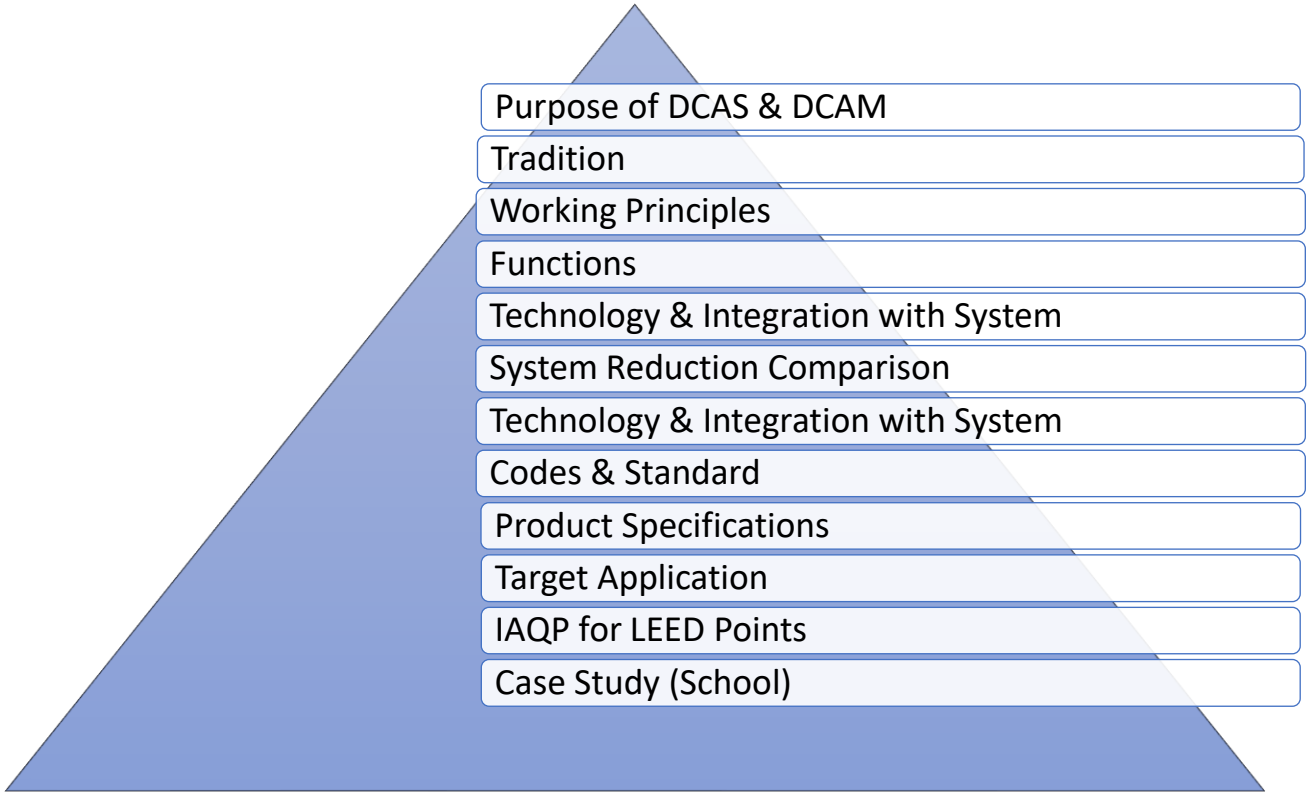
MADE IN INDIA

Air Conditioning | Air Purification | Air Distribution | Pre-Insulated Pipes

www.zecoaircon.com

Worldwide Presence

Contents



The challenge for designers, owners and operators

“How to enhance indoor air quality and resilience while minimizing energy impact?”

Purpose of DCAS & DCAM

The future of really good indoor air quality is going to be alternatives to ventilation, so we don't have to rely on outside air for everything. An engineered ventilation system is more of a direct method of controlling air quality and would be classified as an "Indoor Air Quality Procedure "in ASHRAE 62.1."

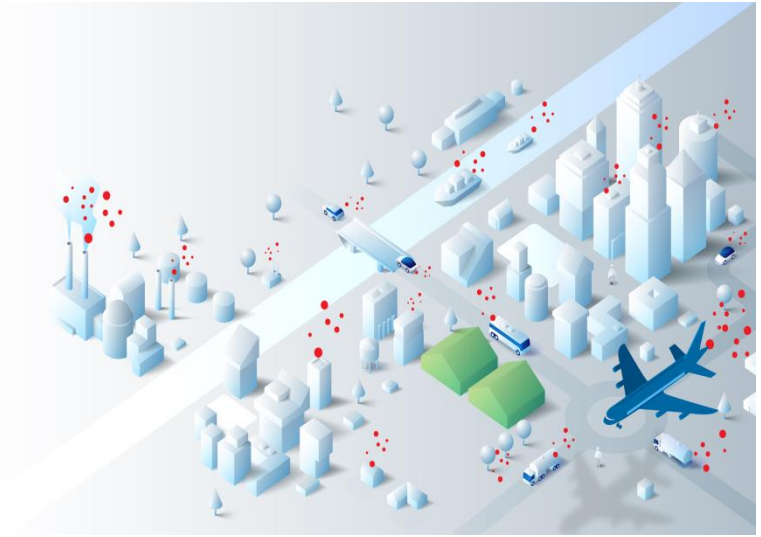
Safely remove CO_2 and VOCs from indoor air so that ventilation rates can be optimized to save money, improve indoor air quality, and reduce carbon emissions.

To reduce the carbon foot print/ decarbonization.

Maintain AQI as per ASHRAE.

Contaminants generates from occupancy, furniture, paints, carpets etc.

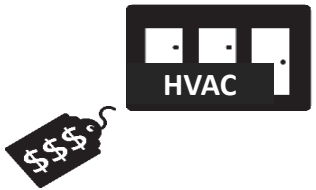
Will reduce the total fresh air requirement by eliminating CO2 and other contaminants.



Purpose of DCAS & DCAM

ZECO
We breathe air into your life

Save money on new HVAC equipment



CAPEX

Reduce HVAC EUI & energy costs by 40%

OPEX

Lower Carbon Emissions & Improve IAQ

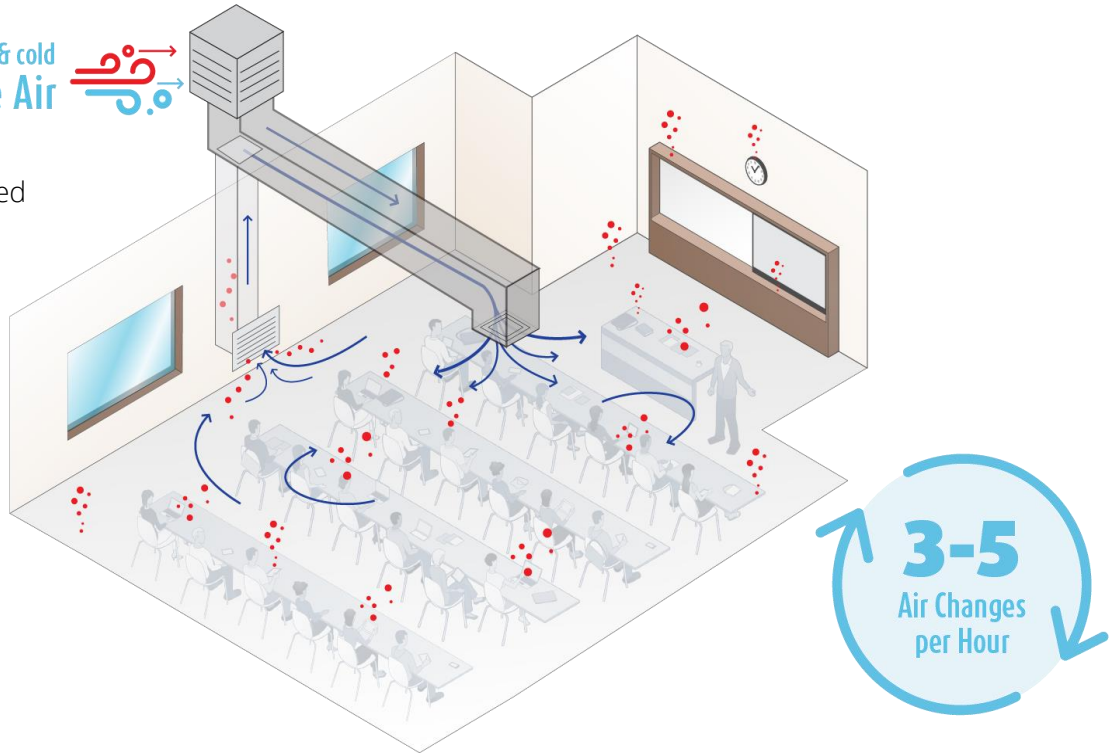
Air Quality

Earn points for LEED & WELL

Green Buildings

Tradition

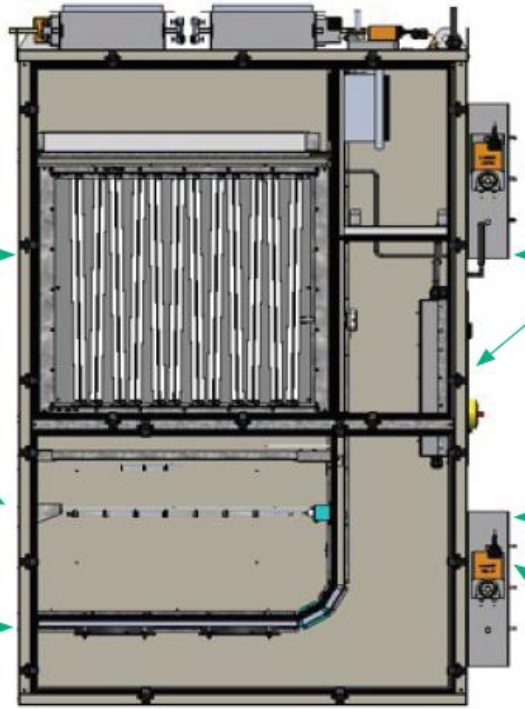
Large volumes of outside air mixed with recirculated air to dilute indoor generated contaminants



Conditioned air

Contaminated air generated by people and the building

What is Inside Module



Cartridge Bank
Houses a set of 12 air-permeable sorbent cartridges

Heater
Raises the internal temperature to release captured contaminants during regeneration

Fans (2)
Fans control airflow through the module

Control Board
Controls components integral to the HLR 14M Module

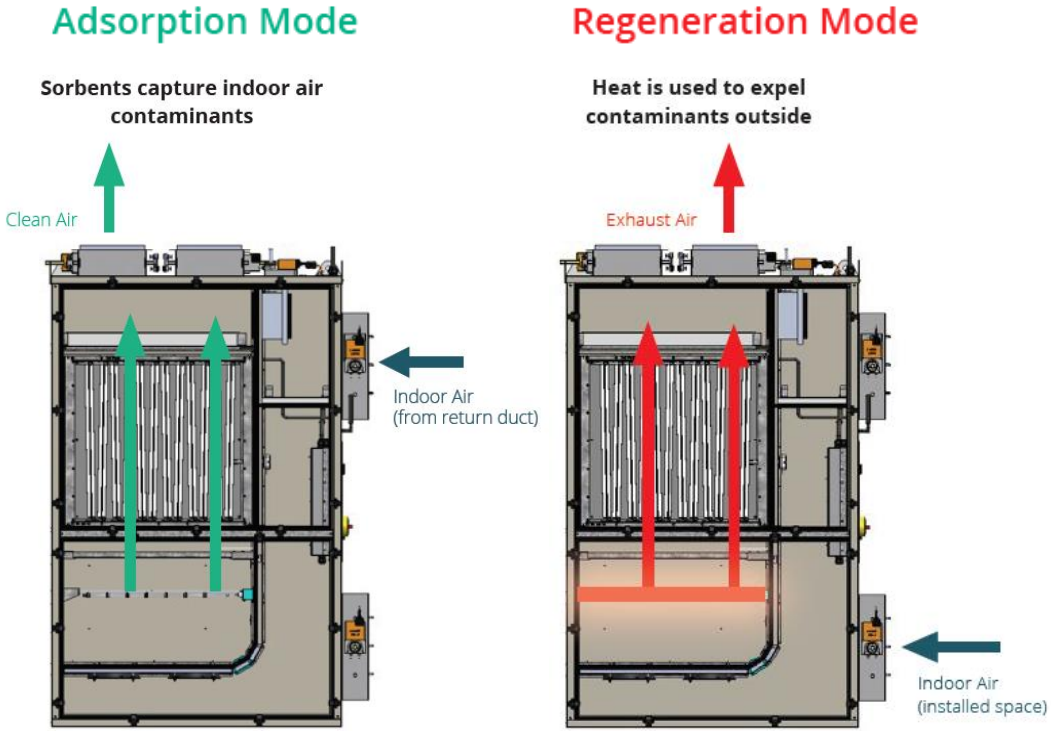
Actuators and Dampers (5)
Automatically control airflow paths during adsorption and regeneration

Sensors
Measure the indoor environmental air quality

Working Principle

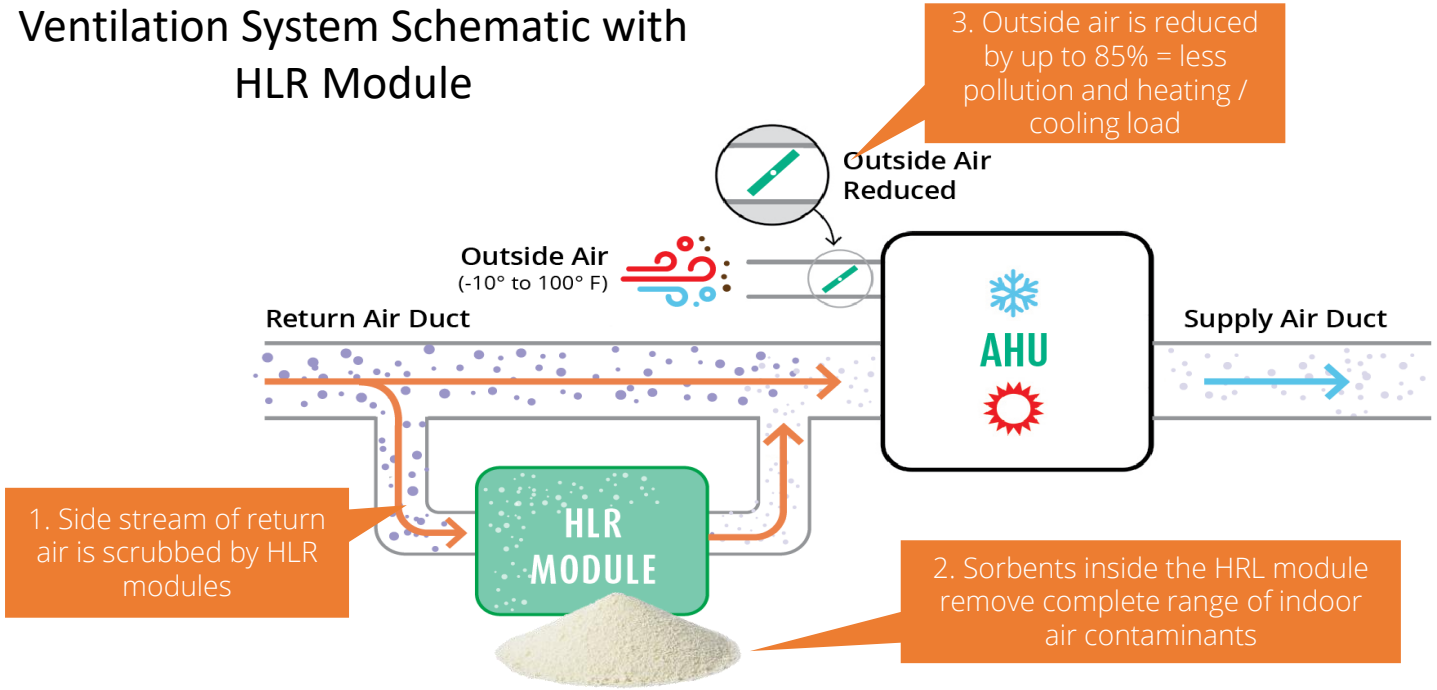
Adsorption Mode – HLR Modules can capture a wide range of molecular contaminants including CO_2 without producing any by-products

Regeneration Mode – When used to capture CO_2, regeneration process is used to vent captured CO_2 *outside* the building



Functions

Ventilation System Schematic with HLR Module

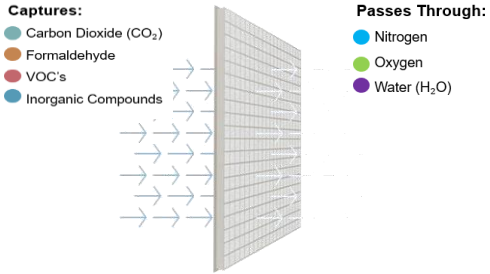


Zeco & enVerid's gaseous air cleaning technology is ASHRAE compliant

Sorbent Media Blend

Sorbent media blend addresses all ASHRAE defined contaminants

Sorbent Filters



Media is loaded into sorbent filters used in air cleaning systems

Air Cleaning Systems

Filters are use in standalone units and inside traditional HVAC systems

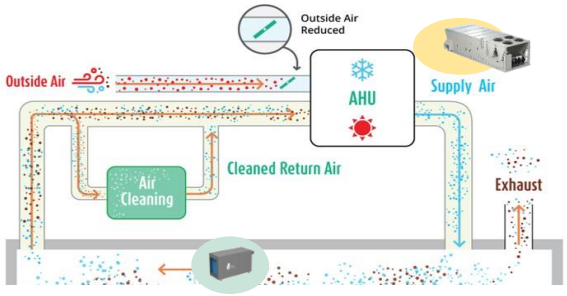
Performance against all the ASHRAE defined contaminants has been demonstrated in third-party labs according to the ASHRAE 145.2 test method for gas-phase air cleaners and field validated by the U.S. Dept. of Energy.

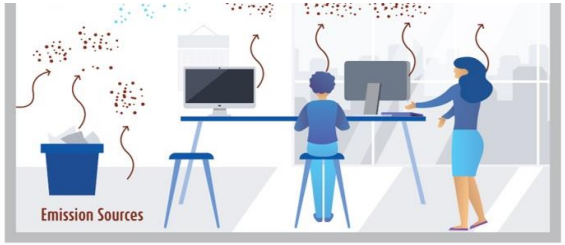
Simple integration options for new and existing HVAC systems

Standalone Air Cleaning Systems

- Used in new and existing buildings
- Installed in mechanical rooms, on roofs, or directly in occupied spaces
- 3 models for a variety of applications

Installation Options





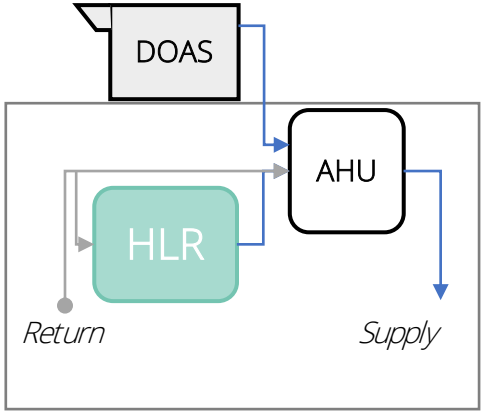
Return air from the space is cleaned & recycled; outside air is reduced to save energy

Integrated Air Cleaning Systems

- Sorbent air cleaning inside HVAC systems
- Used anywhere new HVAC systems are installed (roofs and mechanical rooms)
- Simpler, lower cost installation

Flexible Integration Options with Dedicated Outside Air Systems

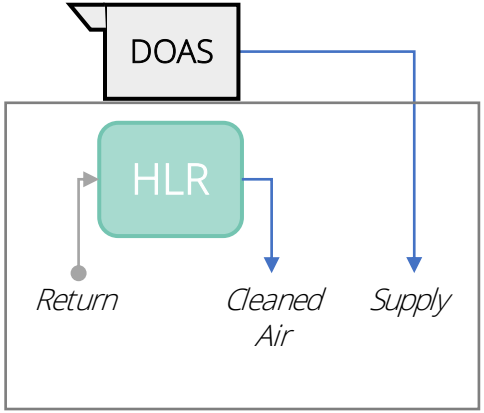
AHU



Supply cleaned air to AHU

Reduce DOAS load

Decoupled

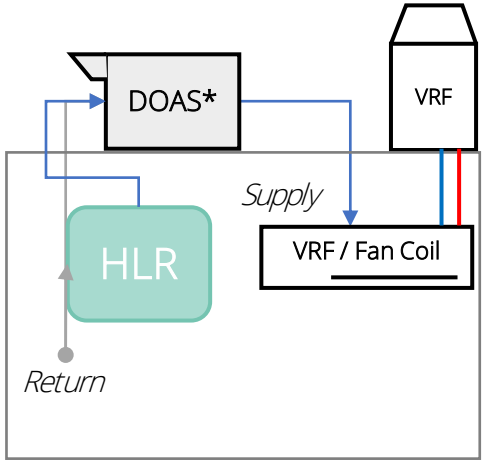


Locally clean air within the space to reduce DOAS load

Independence from DOAS reduces floor space and duct runs

Best applied in large spaces/zones with mixing

VRF



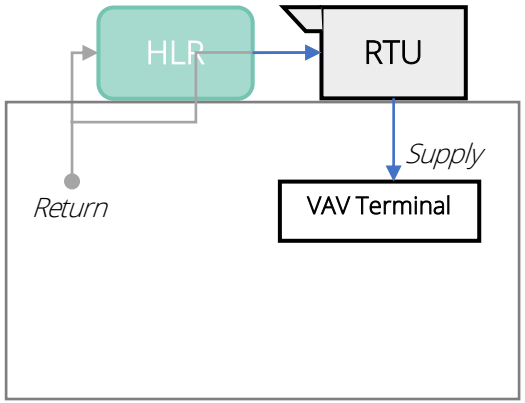
Supply cleaned air to DOAS to reduce load and ERV needs

Approach may be used with chilled beams, fan coils, heat pumps, VRF, and other equipment

* Adding return air creates a mixed-air system

Flexible Integration Options with Mixed Air Systems

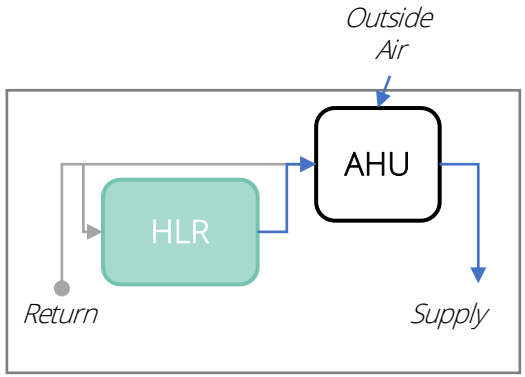
RTU



Supply cleaned air to RTU

Reduce DOAS load

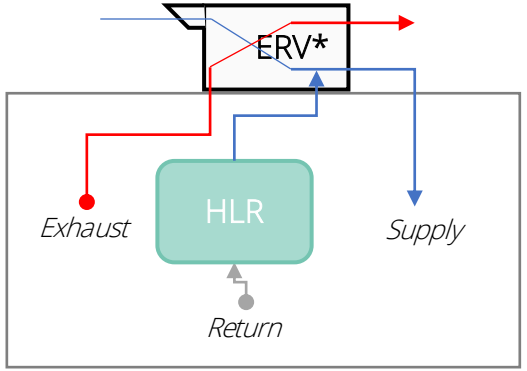
AHU



Supply cleaned air to AHU

Reduce DOAS load

ERV/HRV



Downsize ERV by adding cleaned air to building supply

* Adding return air creates a mixed-air system

Comparisons

TFA

- **100% Fresh Air Load on Coil**
- **High power consumption**

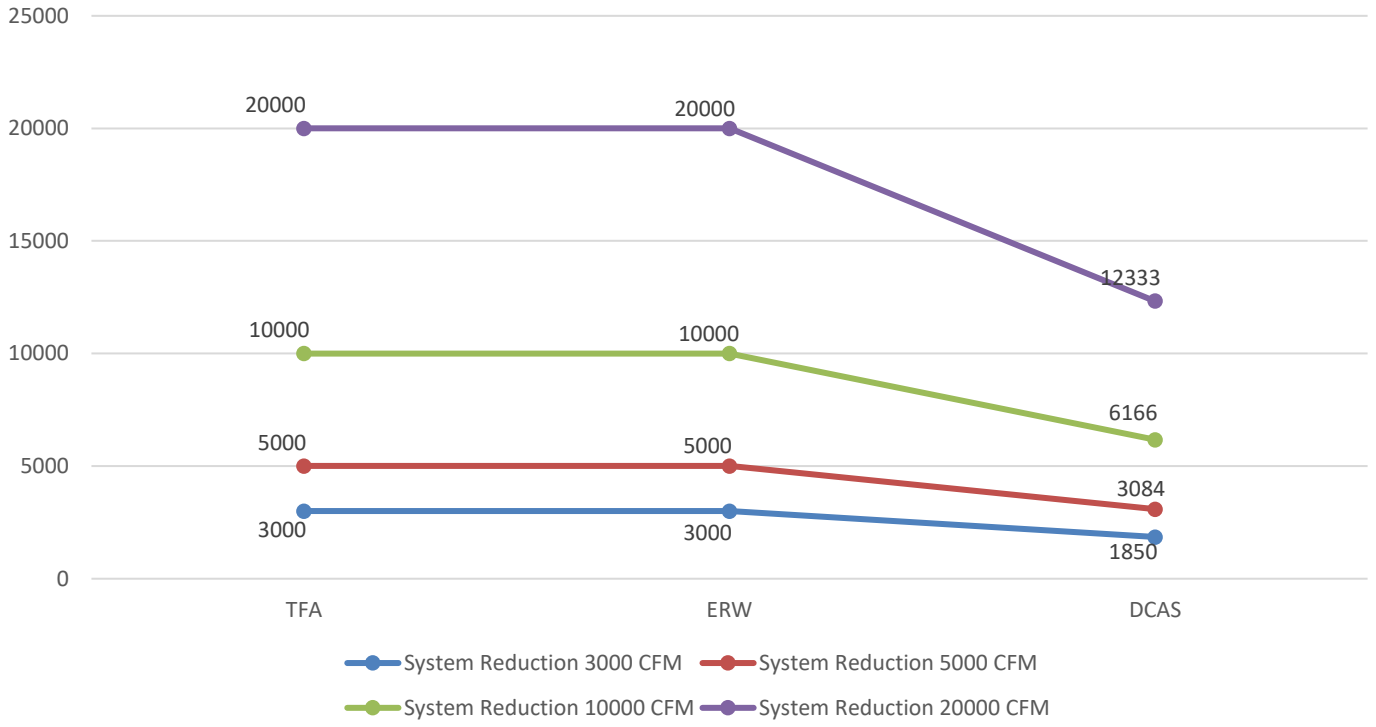
ERW

- **Use of Heat Recovery wheel**
- **Wastage of conditioned air**
- **Wastage of energy and money**
- **Less Power savings**

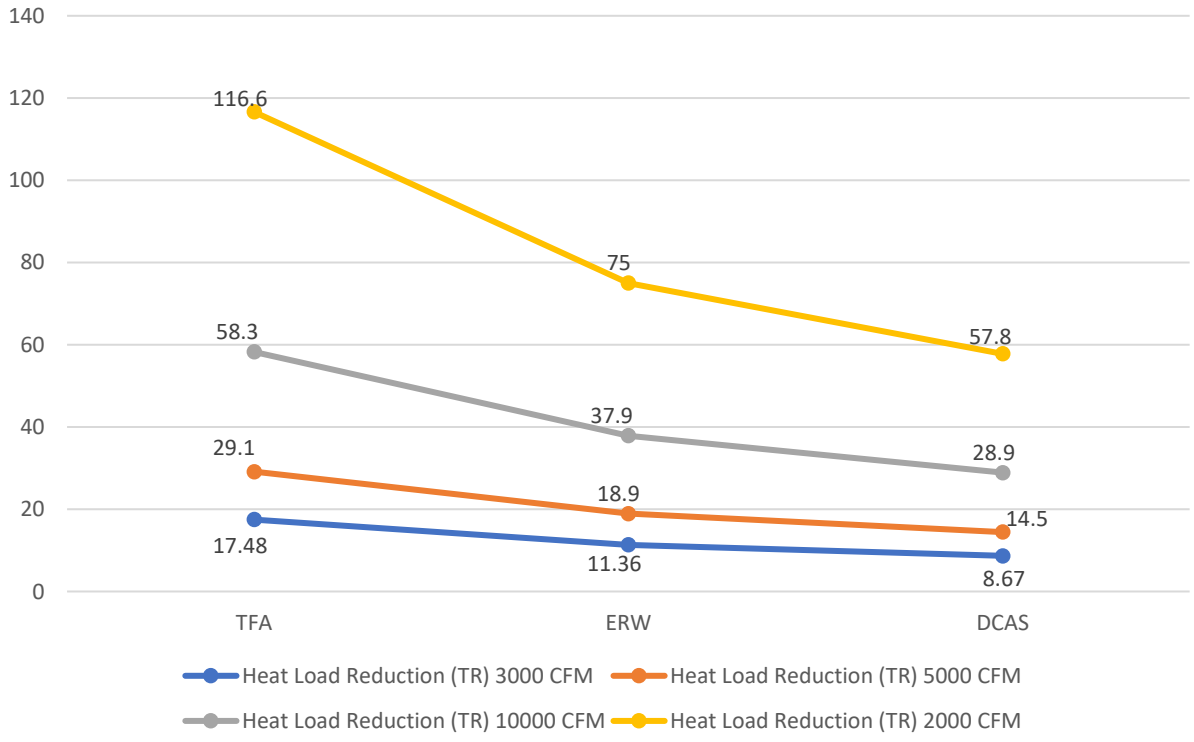
DCAS / DCAM

- **Improve Indoor Air Quality**
- **Reduce VOCs, CO2, Formaldehyde, Inorganic compound etc.**
- **Enhanced Filtration**
- **Noise & Vibration free**
- **Low power consumption**
- **Reduces outdoor air requirement**
- **Reduced HVAC load**
- **LEED | Platinum |Gold Certification**
- **Less carbon emission of buildings**
- **Greater power savings**

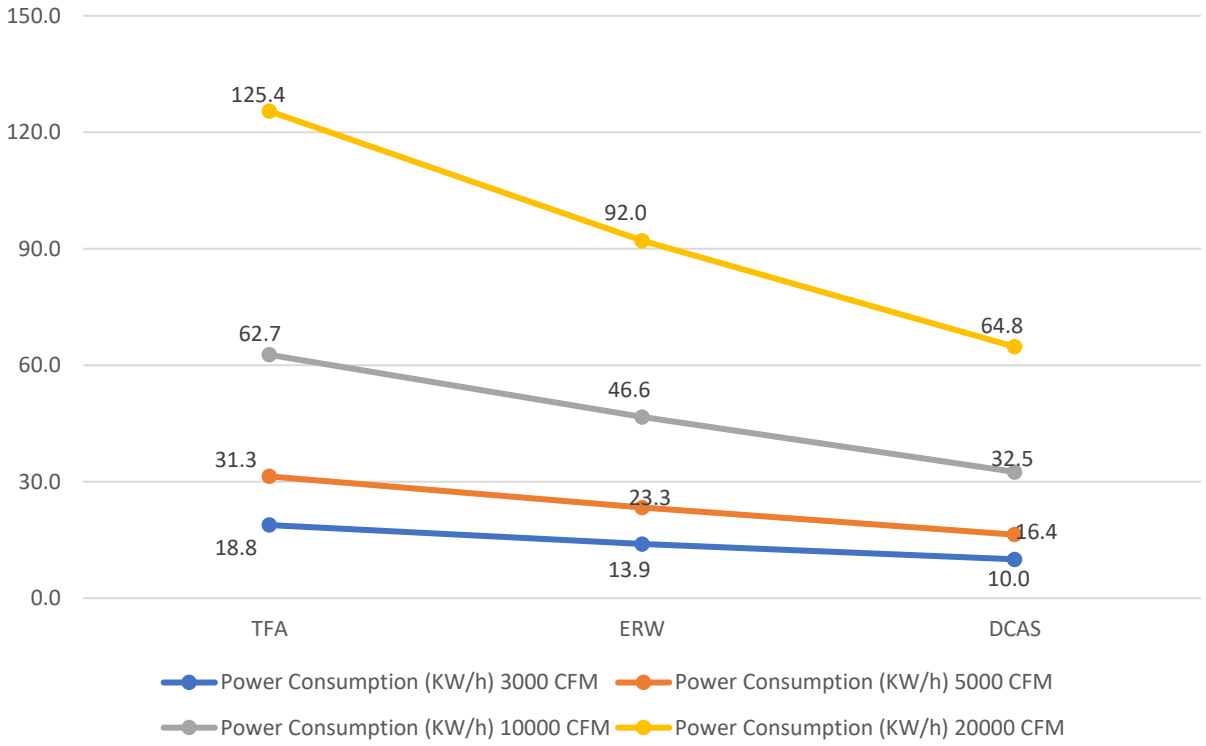
System Reduction (CFM)



System Reduction (TR)



System Reduction (KW/h)

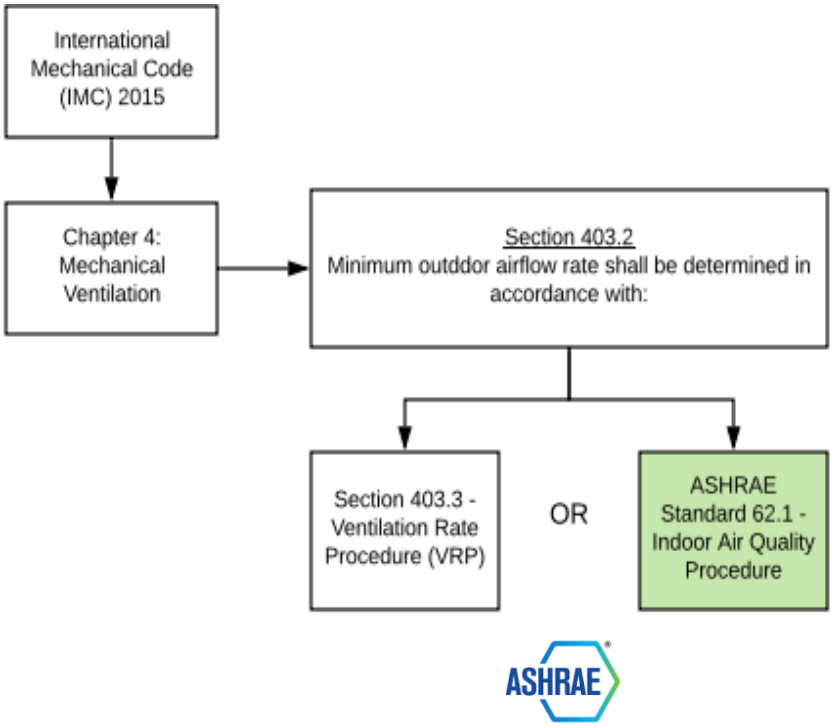


The IMC Allows IAQP and Air Cleaning

From IMC Section 403.2

"Where a registered design professional demonstrates that an ***engineered ventilation system design*** will prevent the maximum concentration of containments from exceeding the obtainable by the rate of outdoor air ventilation determined in accordance with Section 403.3, the ***minimum required rate of outdoor air shall be reduced*** in accordance with such engineered system design."

"An engineered ventilation system is more of a direct method of controlling air quality and would be classified as an **"Indoor Air Quality Procedure"** in ASHRAE 62.1."



ASHRAE Standard 62.1 Overview

ASHRAE Std. 62.1: Ventilation Rate Procedure (VRP)

PRESCRIPTIVE

ASHRAE Std. 62.1: Indoor Air Quality Procedure (IAQP) – since 1979*

PERFORMANCE-BASED

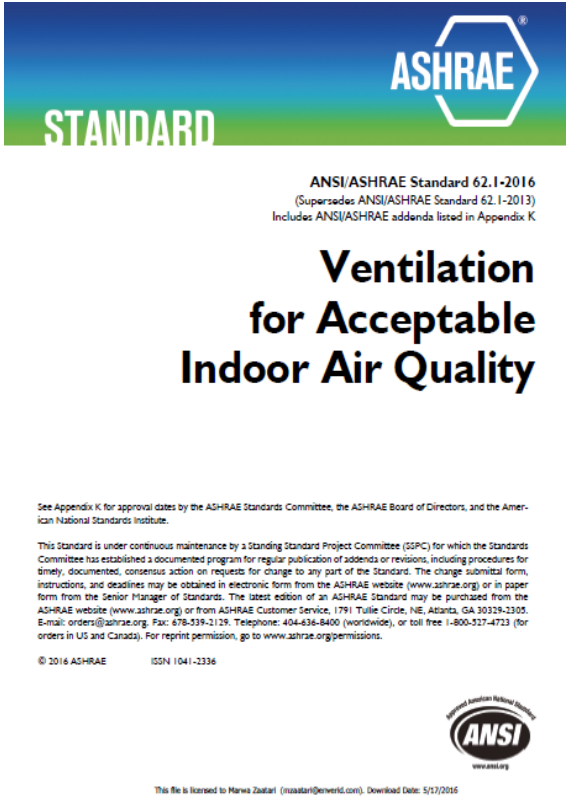
Pollutant control ventilation (PCV)

Cleaning efficiency

Compliance report

Occupant survey

* Since 2006, the International Mechanical Code (IMC) allows for an engineered solution showing control of contaminant concentrations (IAQP).


STANDARD

ANSI/ASHRAE Standard 62.1-2016
(Supersedes ANSI/ASHRAE Standard 62.1-2013)
Includes ANSI/ASHRAE addenda listed in Appendix K

Ventilation for Acceptable Indoor Air Quality

See Appendix K for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, and the American National Standards Institute.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Senior Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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ANSI
www.ansi.org

ASHRAE Standard 62.1 Overview

- Breathing zone outdoor airflow: use Table 6.2.2.1 rates (pages 12-15)

Breathing Zone Outdoor Airflow CFM

People Component

Building Component

$$V_{bz} = R_p P_z + R_a A_z$$

- R_p: Minimum CFM/Person
- P_z: Zone Population
- R_a: Minimum CFM/ft^2
- A_z: Zone Floor Area

Definition: Breathing zone is the region within an occupied space between planes 3-72 in. above the floor and more than 2 feet from the walls.

ASHRAE Standard 62.1–2016

VRP + Demand-Controlled Ventilation (DCV)

Based on CO_2 concentrations as a surrogate for human occupancy

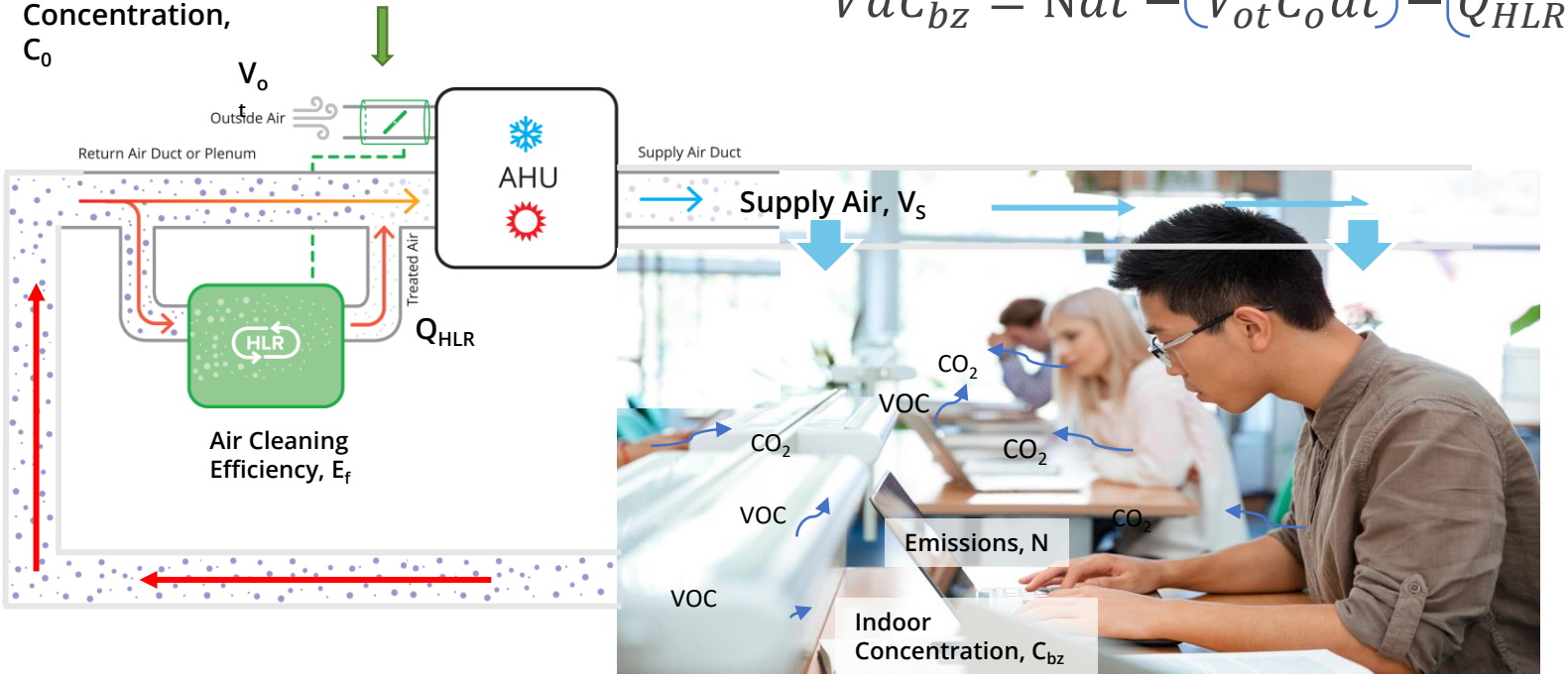
$$V_{bz} = R_p P_z + R_a A_z$$

- R_p: Minimum CFM/Person
- P_z: Actual Zone Population
- R_a: Minimum CFM/ft^2
- A_z: Zone Floor Area Constant

IAQP: Objective Evaluation Steps

Mass Balance Analysis

$$VdC_{bz} = \mathrm{N}dt - \underbrace{V_{ot}C_o dt}_{\text{Dilution}} - \underbrace{Q_{HLR}E_f C_{bz} dt}_{\text{Cleaning}}$$



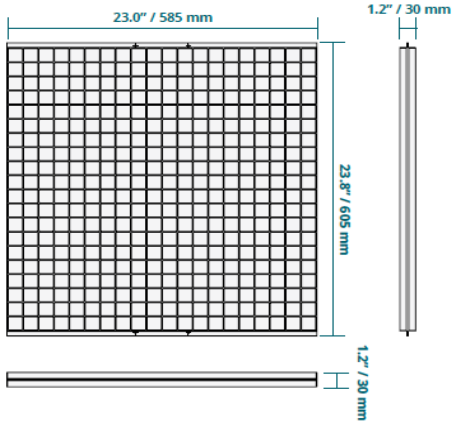
Product Specifications

ZECO
We breathe air into your life

Sorbent Filters

- captures molecular contaminants of concern including CO_2, VOCs, and ozone while producing no by-products
- Low-cost contaminant capture
- Exceptional formaldehyde removal
- Multiple other air-cleaning functionalities, including CO_2
- Formation of high surface solid sorbents and catalysts

SPECIFICATIONS *Model SVT-250*	
WIDTH	23.0" / 585 mm
LENGTH	23.8" / 605 mm
THICKNESS	1.2"/ 30 mm
WEIGHT	16.5 lbs / 7.5 kg



Sample Compounds	enVerid Sorbent Ventilation Technology™	Sample Combination Chemical/Particle Filter
Carbon Dioxide[1]	57%	n/a
Ozone[2]	70%	30%
Formaldehyde[2]	99%	90%
Toluene[2]	52%	48%

Product Specifications

ZECO
We breathe air into your life

Reduce Outdoor Air Requirement upto 80% when deployed in accordance with the ASHRAE IAQ Procedure.

Standard ASHRAE 62.1 for Ventilation & acceptable indoor air quality

Gas phase air cleaning efficiency under ASHRAE 145.2

Do not Produce Ozone (UL 2998 for ozone Generation)

Air Cleaning Efficiency for enVerid HLR Modules

Design Compound	Efficiency	Third-Party Lab	Test Method
Acetaldehyde	99%	LMS Technologies	ASHRAE 145.2
Acetone	99%	LMS Technologies	ASHRAE 145.2
Benzene	87%	RTI International	ASHRAE 145.2
Dichloromethane	54%	LMS Technologies	ASHRAE 145.2
Formaldehyde	99%	LMS Technologies	ASHRAE 145.2
Naphthalene	87%	RTI International	ASHRAE 145.2
Phenol	60%	RTI International	ASHRAE 145.2
Tetrachloroethylene	54%	LMS Technologies	ASHRAE 145.2
Toluene	52%	RTI International	ASHRAE 145.2
1,1,1-trichloroethane	54%	LMS Technologies	ASHRAE 145.2
Xylene, total	60%	RTI International	ASHRAE 145.2
$PM_{2.5}$	MERV 11	RTI International	ASHRAE 52.2
Ozone	70%	RTI International	ASHRAE 145.2
CO_2	57%	Hygieia Sciences	ASHRAE 145.2

Target Application

- Office buildings: High rise, or medium/large low rise
- Colleges / universities / libraries
- Malls
- Hotels, Motels,
- Common areas/Conference rooms
- Green / LEED Buildings / WELL Buildings
- Conditioned warehouse

The IAQP can be used to earn LEED points

Up to 13 points can be earned under **LEED BD+C** by applying the IAQP with air cleaning.

Credit Area	Requirements		Points	Awarded Credit
EQpc124 Performance-based indoor air quality design assessment Alternative compliance path to earn up to 7 Environmental Quality and Innovation credits.	Tier 1. Contaminant based IAQ design		1	Enhanced indoor air quality strategies
	Tier 2. IAQ baseline evaluation	Path a. LEED-specific contaminant list	2	Indoor air assessment
		Path b. Project specific contaminant list	1	Enhanced indoor air quality strategies
	Tier 3. Demonstrate IAQ performance		3	Indoor air assessment
				Construction IAQ management
				Low-emitting materials
	Achieve Tier 1, 2,Path a, AND 3		Prereq	Minimum IAQ performance
Energy & Atmosphere	Demonstrated increased energy efficiency		Up to 6	Optimize Energy Performance

Up to 15 points can be earned under **LEED O+M** using the Indoor Air Quality Procedure pilot credit (EQpc68), the performance based indoor air assessment pilot credit (EQpc119), and by earning points in the Energy & Atmosphere credit area by demonstrating increased efficiency.

The IAQP can be used to earn LEED points

Up to 17 **LEED** points can be earned by applying the IAQP in Existing Building.

0+M Pilot Credit	Tier	Points	Awarded Credit
EQpc68	IAQ Procedure	Prereq	Minimum IAQ performance
EQpc119	Baseline IAQ Evaluation	2	Indoor air quality management program
	IAQ Optimization	2	Enhanced indoor air quality strategies
		1	Green cleaning products & materials
		1	Innovation
	Ongoing IAQ Performance	3	Innovation
Energy & Atmosphere	Demonstrate increased energy efficiency	Up to 6	Optimize Energy Performance
	Participate in Demand Response Program	2	Demand Response

Case Study: Thorough good Elementary School (VA)

PROJECT GOALS

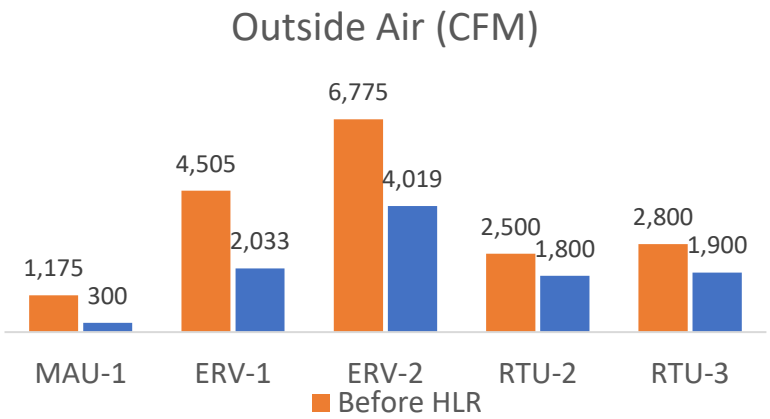
- LEED Gold certification
- Improved indoor air quality
- Peak cooling and heating load reduction

enVerid Project Details	
Location	Virginia Beach, VA
Owner	Viriginia Beach City Public Schools
Contractor	Conrad Brothers
MEP	exp.
Year Installed	2020
Project Type	New Construction
Floor Area	91,913 ft^2
HLR Modules	6 Rooftop & 1 Indoor
LEED/WELL	LEED Gold

Partners

Case Study: Thorough good – Outside Air & Indoor Air Quality

The HLR design reduced outside air requirements by 43% from 17,755 CFM to 10,052 CFM



Indoor air contaminant levels were measured in 6 locations and remained well below LEED limits

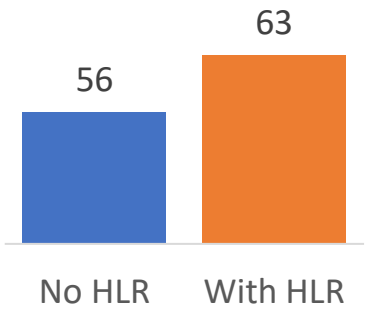
Contaminant	LEED Limit (ug/m3)	Average Concentration (ug/m3)
Formaldehyde	20	**16**
Total Volatile Organic Compounds (TVOC)	500	**375**
Carbon Dioxide	800 ppm (VRP equivalent)	**569 ppm**
PM2.5	12	**1**

Indoor formaldehyde and particulate mater levels were recorded at concentrations below outdoor "fresh" air.

The project demonstrated that HLR modules can be used to provide superior indoor air quality with much less outside air.

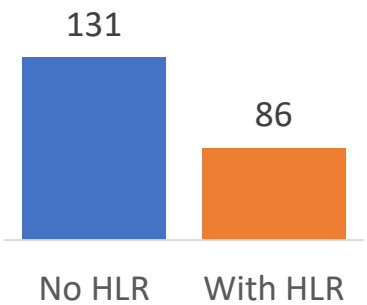
Case Study: Thorough good – Project Outcomes

LEED Points



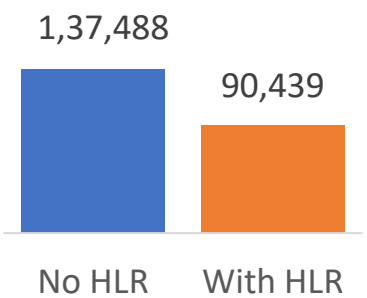
From LEED Silver to LEED Gold rating

Peak Cooling Load (tons)



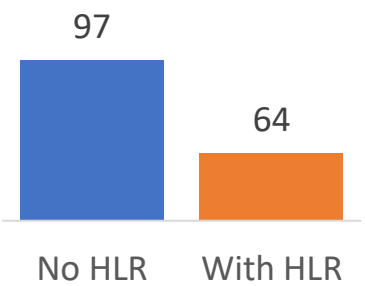
$60k first cost savings on new HVAC system

Ventilation Energy (kWh/yr)



$100k utility bill lifetime savings

Metric Tons CO_2/yr



Reduced 42 metric tons CO_2 annually

These outcomes were achieved while maintaining indoor air quality well below LEED limits

ZECO®
We breathe air into your life

THANK YOU

Join us with our fight against
Air Pollution