



Reshaping HVAC Design:

Designing for Improved Indoor Air Quality & Energy Efficiency

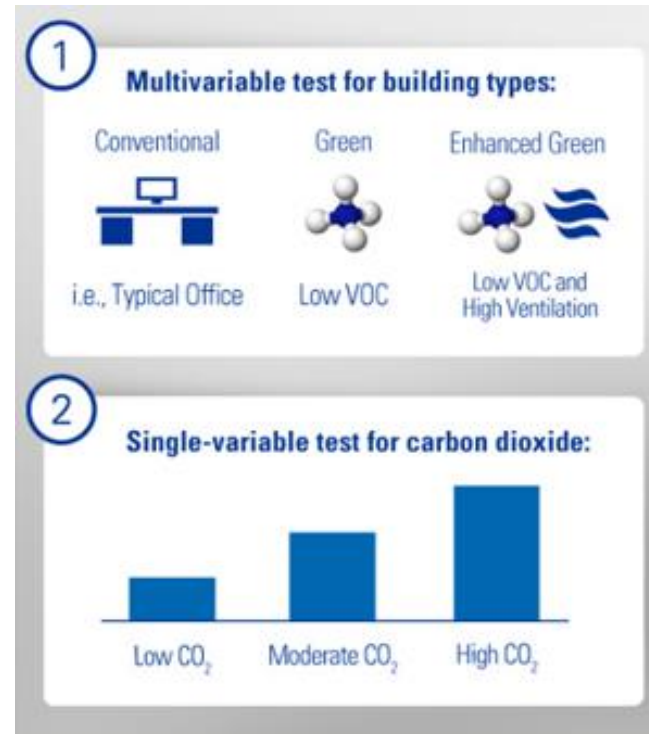


WE SPEND
 **90%**
of
OUR TIME
INDOORS¹



 **10%**
OUTDOORS¹

IAQ Impact on Cognitive Performance



Elevated CO₂ has a direct and negative effect on productivity



Smart Buildings.

Not-So-Smart Ventilation.

Conventional Approach to IAQ

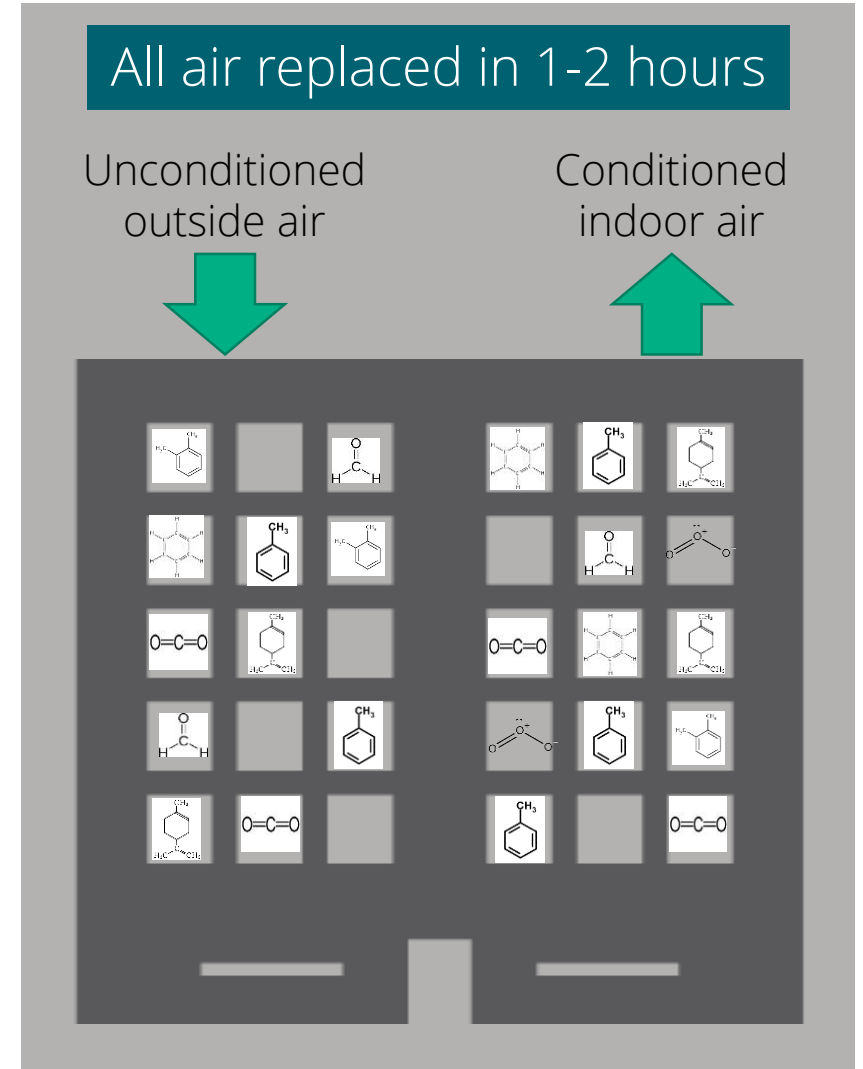
Dilution to Avoid Pollution

Ventilation leads to higher energy costs:

- Outside air is replaced 1-2 time per hour
- Outside air conditioning represents 30-50% of the total load on HVAC systems in most climates



- HVAC capacity
- Energy usage
- Water consumption
- Maintenance



Outdoor Air as a Source of Contaminants

Fresh, Hot & Polluted Air

Ventilation leads to increase of outdoor generated pollutants indoors,
PM_{2.5} - Ozone - CO - NO_x - SO_x

	American Lung Association		EPA
Outside air ratings	24-Hour Particle Pollution	Ozone Grade	8-Hr Ozone Classification
Boston	B	F	
Chicago	F	F	Nonattainment
Dallas	B	F	Nonattainment
Houston	C	F	Nonattainment
New York City	F	F	Nonattainment
Miami	B	C	
Washington D.C.	C	F	Nonattainment

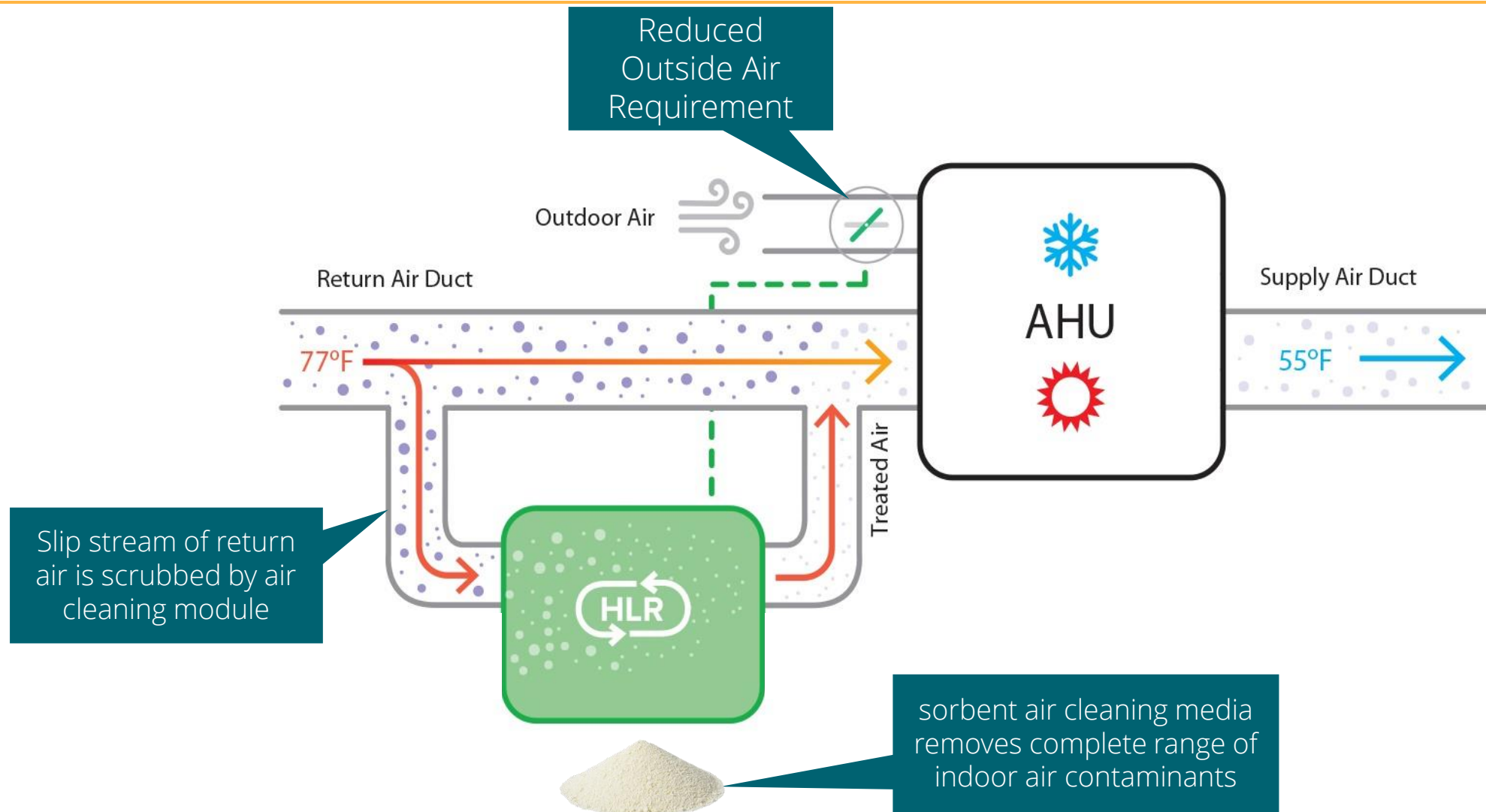
“Fresh” air, anybody?



Air Cleaning + HVAC Load Reduction (HLR)



Maintaining IAQ with Molecular Air Cleaning



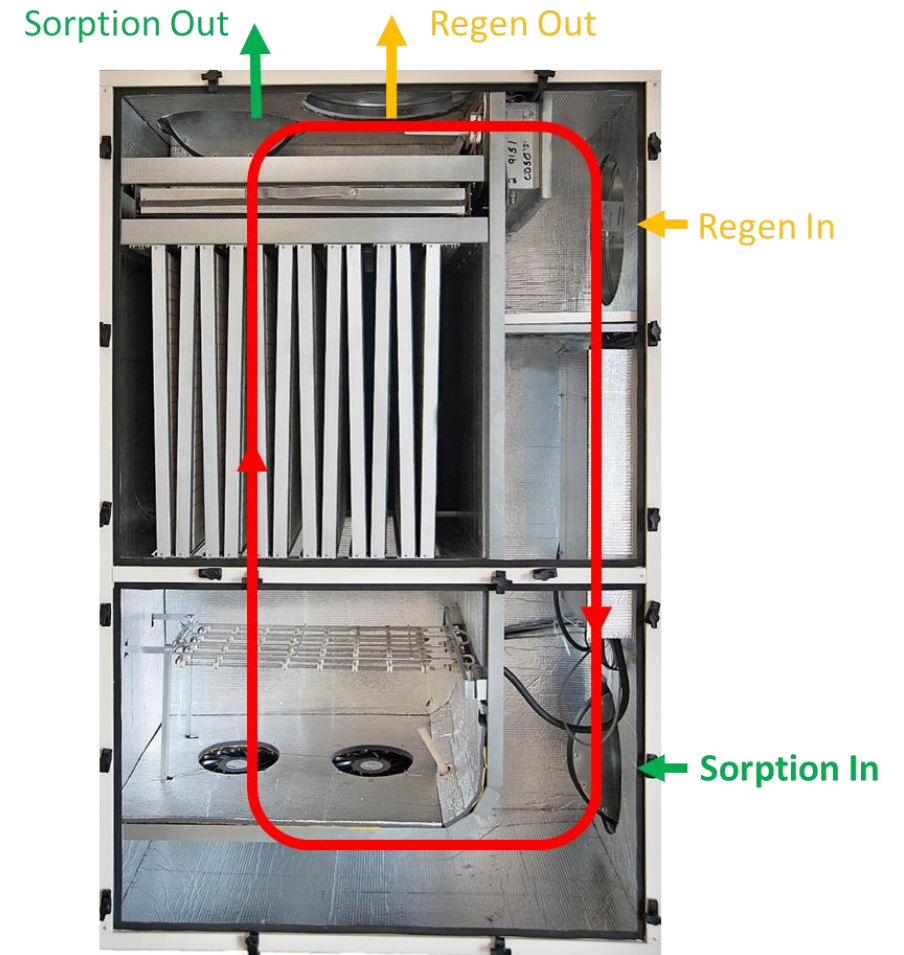
Air Cleaning at High Efficiencies

Self-regenerating Sorbent Media

Highly Efficiency: Air cleaning efficiency measured by third party per ASHRAE Standard 145.2

Gaseous Contaminants (examples)	Cartridge efficiency (%)
Benzene	87%
Carbon Dioxide	57%
Formaldehyde	55%
Hexane	74%
Isopropanol	77%
Ozone	70%
Toluene	52%
Xylene	60%

No By-Products



Thank you.

