



INTEGRATED DESIGN LAB

COLLEGE OF ART AND ARCHITECTURE
University of Idaho



University of Idaho

College of Art and Architecture

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ARCH Chair

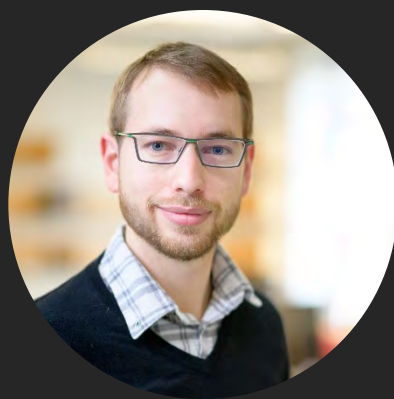
KIM OSBORNE

ARCH Fiscal Officer



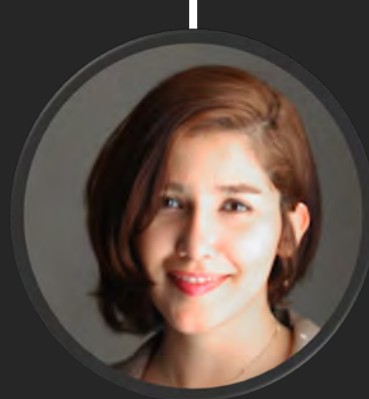
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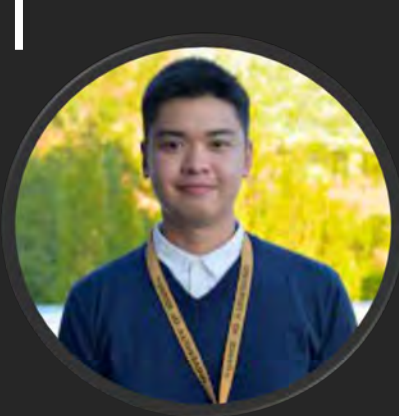
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Ph.D Mechanical Engineering



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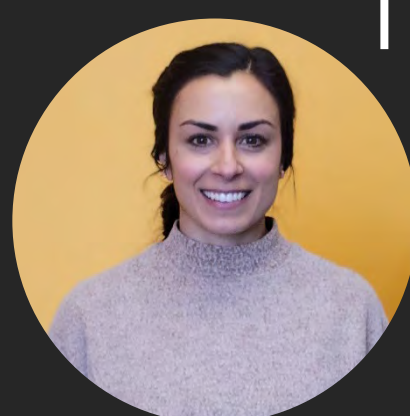
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MALLORY BUSCEMI

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Building Simulation User Group

BSUG

//

BSUG is a free lecture series that brings together architecture and engineering professionals focused on building simulation.

There are six lectures given each year. Lectures are split up to be presented in the first half of the year and the end of the year. Topics include energy modeling software, integrating building performance in the design process, and workflow/methods for an integrated design process. Door prizes are given away each lecture. Prizes focus on energy efficiency or related lecture topics.

Sefaira Architecture, Systems

DesignBuilder

AECOSim

TRACE 3D Plus

eppy

jEPlus

umi

QCoefficient
nsight

Euclid, Modelkit

Simergy

CityBES, CBES, C

OpenStudioSDK



Energy Resource Library

ERL

// The ERL is a free resource for Idaho Power customers. The library provides hundreds of free tools and guides to help experts and non-experts alike assess a building or systems' energy performance and energy use patterns, and identify opportunities for energy-saving improvements.



Technical Design Assistance

//

The IDL can provide varying levels of energy efficiency technical assistance and project-based training to building industry professionals and customers in Idaho Power's service area.

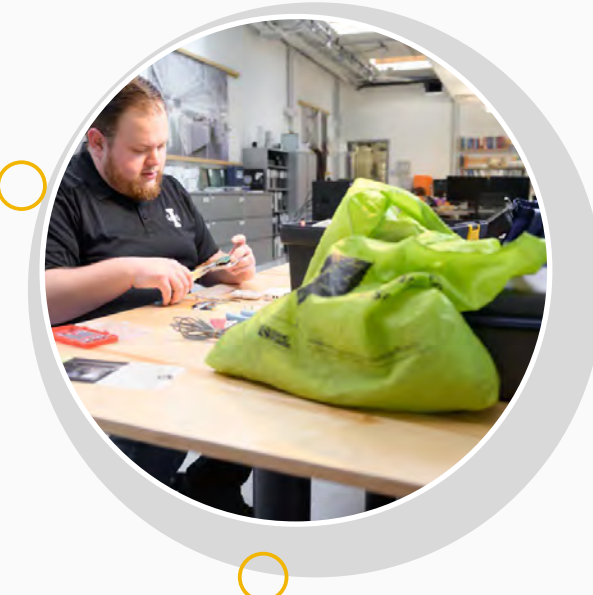
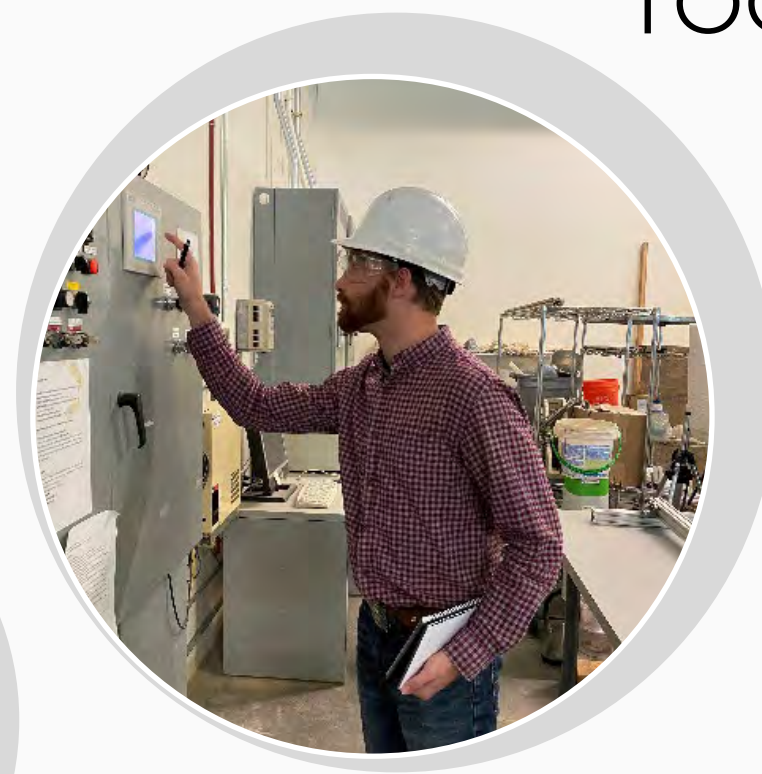
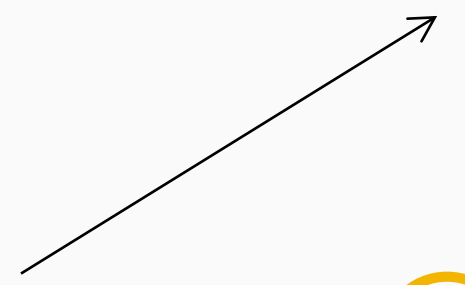
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TOOLS + MEASUREMENTS

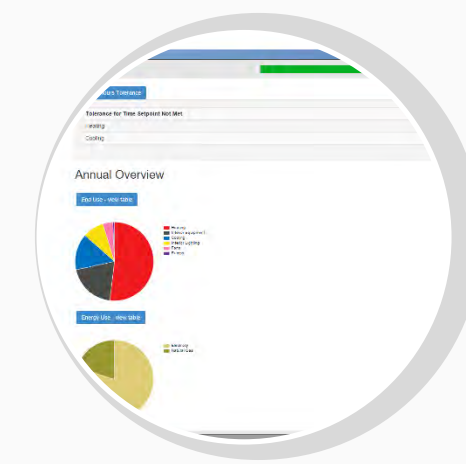
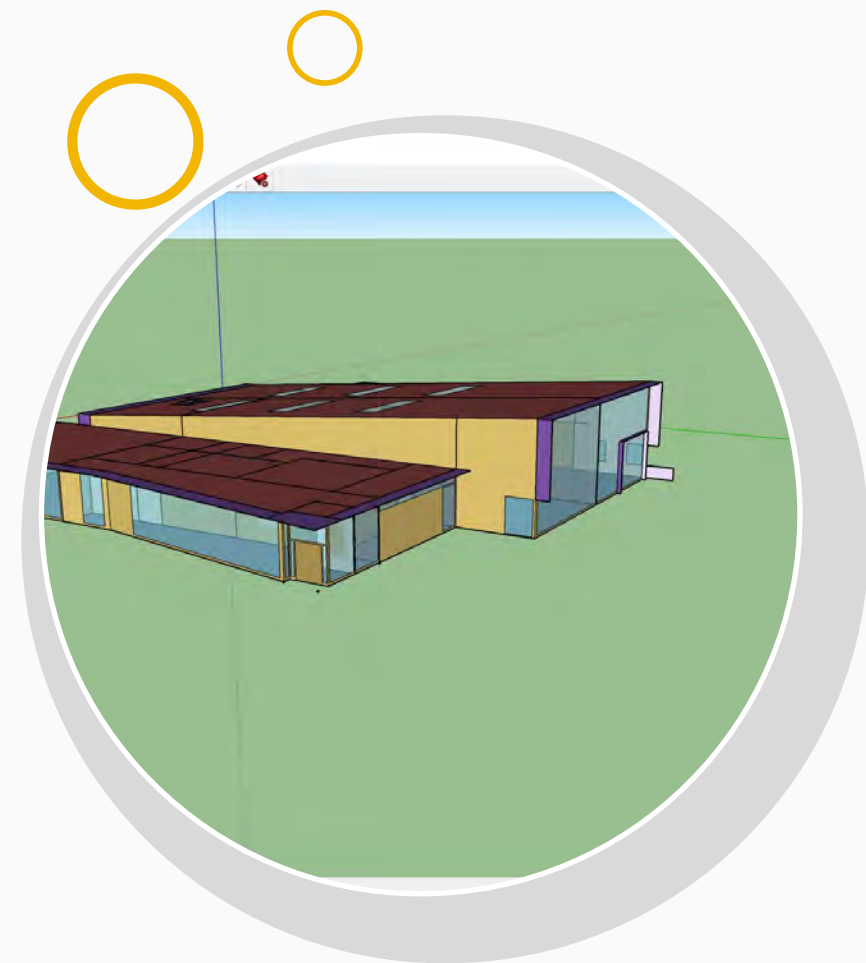


LECTURES



PHYSICAL

VIRTUAL



MODELING & ESTIMATES



IDL WORKFLOW



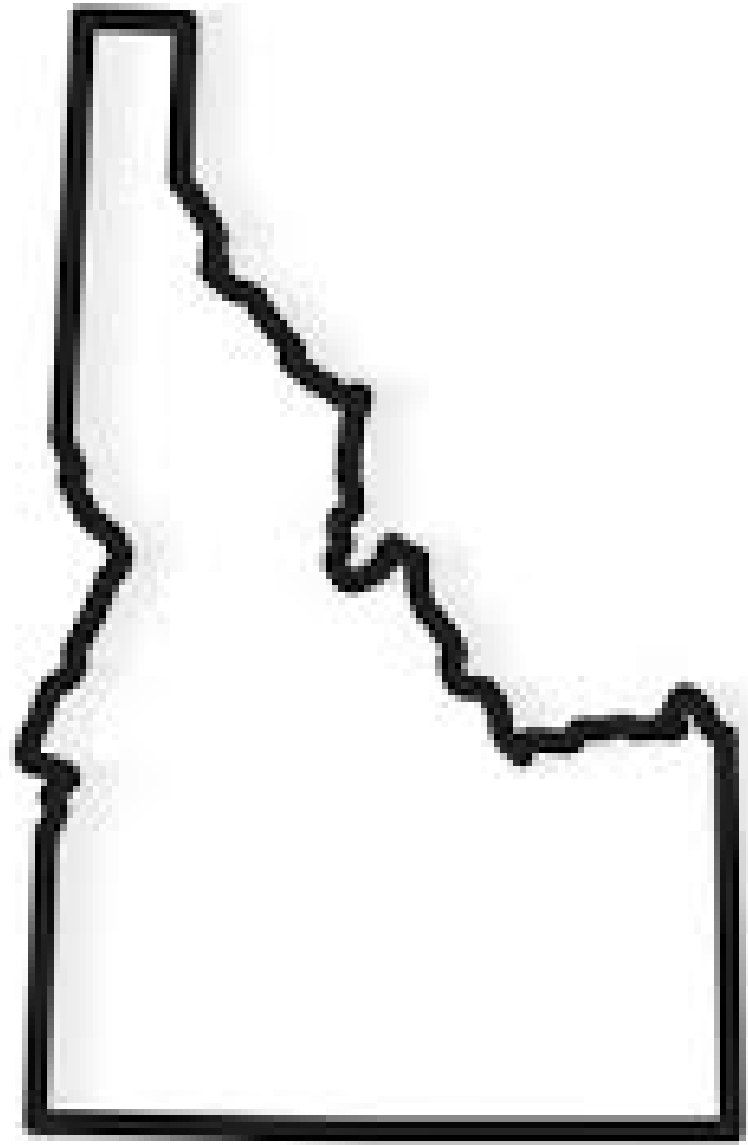
ENERGYCODES

ANALYSIS OF IDAHO'S PROPOSED CHANGES

Zero-Based Regulation

Idaho Executive Order No. 2020-01

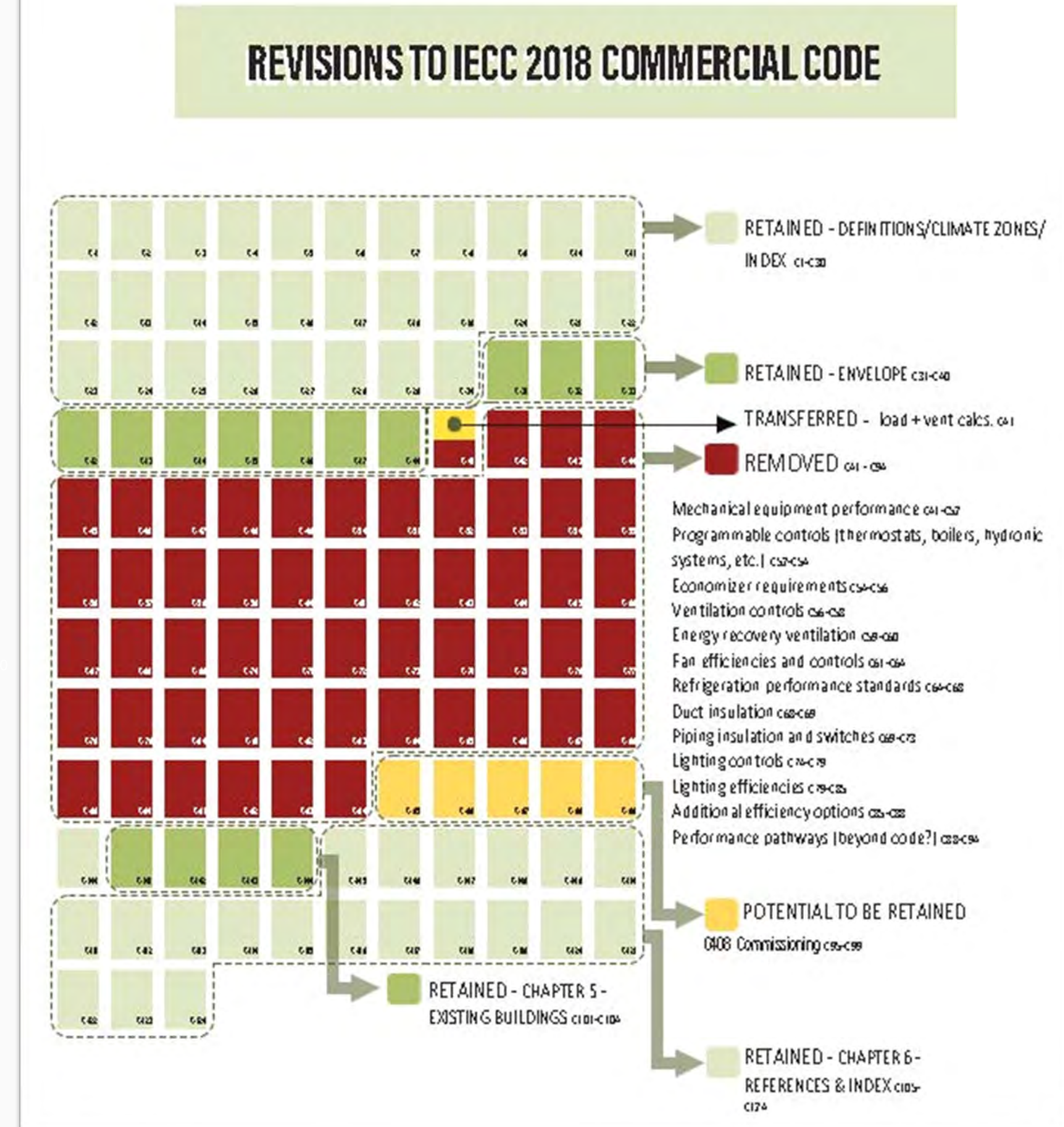
IDAHO'S CLIMATE



- Idaho currently adheres to the 2018 IECC (with some exceptions)
- There is a stronger political will to decrease regulation than there is to combat climate change
- No city can adopt a stricter energy code than the state minimum (HB 660)

Zero-Based-Rulemaking

1. Removing all lighting requirements
2. Removing most of mechanical code
3. Removing water heating requirements
4. Removing additional efficiency options



Impact Modeling: How does this compare to other states?

- **Alaska:**

While Alaska does not have a mandatory statewide code, the state has developed Building Energy Efficiency Standards (BEES), which is based on the 2018 IECC with state-specific amendments.

- **Wyoming**

Wyoming allows different jurisdictions to have more stringent codes. Thus, the city of Cheyenne requires blower door testing and the city of Casper has adopted IECC 2021 with some local amendments.

- **North Dakota**

North Dakota is a home rule state. “While it has no statewide mandatory energy codes, the state recently adopted the 2018 IECC as its voluntary commercial code. Approximately 91% of the state’s population lives in a jurisdiction that has adopted the ND State Building Code which includes the 2018 IECC.”¹

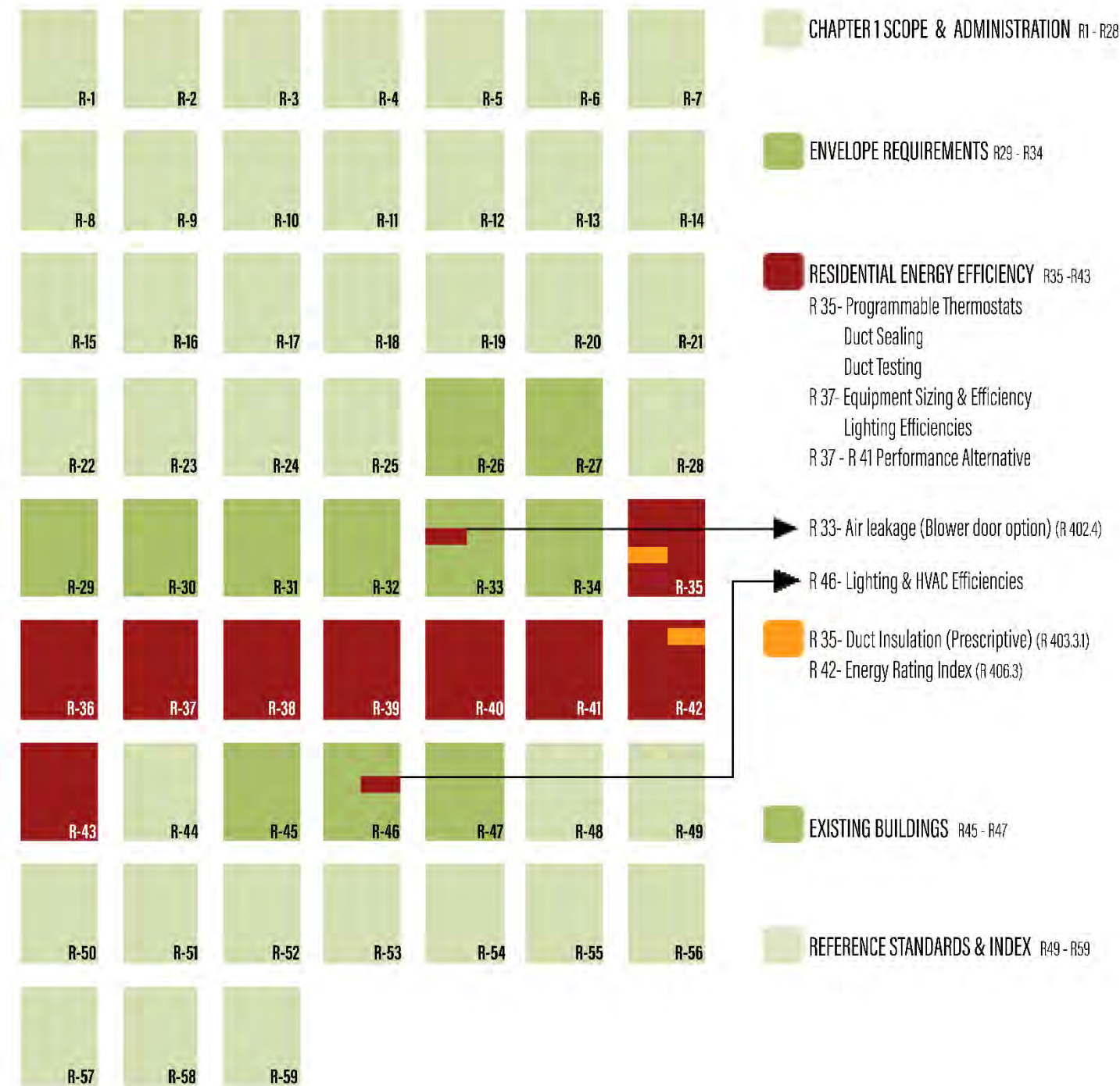
- **Utah**

Utah passed HB 218 adopting the 2018 IECC commercial provisions in their entirety. Localities may also adopt stretch codes.¹

1. <https://database.aceee.org/state/residential-codes>

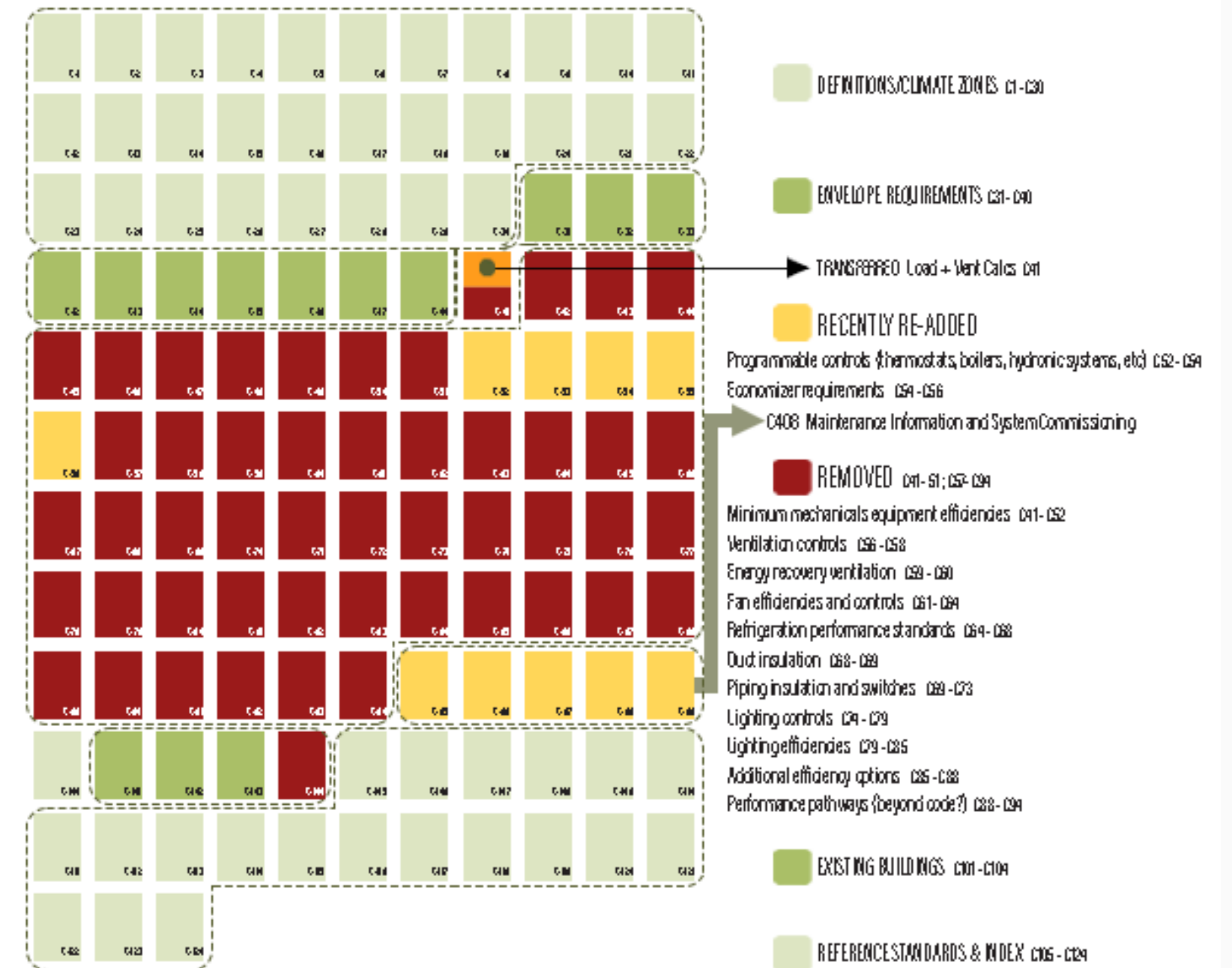
REVISIONS TO IECC 2018 RESIDENTIAL CODE

- Basic and innocuous language (definitions, indexes, etc.)
- Retained with adjustments
- Retained energy code provisions
- Code provisions set to be deleted



REVISIONS TO IECC 2018 COMMERCIAL CODE

- Basic and innocuous language (definitions, indexes, etc.)
- Potentially transferred to other codes
- Retained energy code provisions
- Initially deleted, recently re-added provisions
- Code provisions set to be deleted

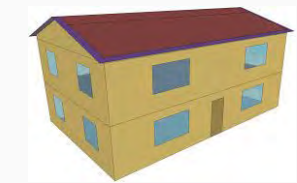


Impact Modeling: What effect will this have?

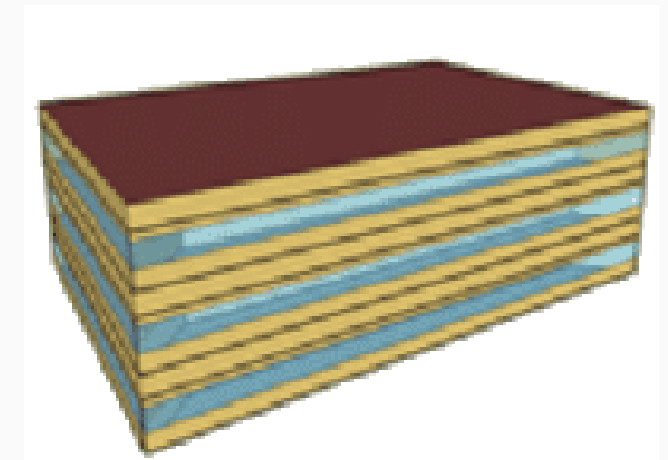
AFFORDABILITY

Last month, more than 1 in 5 Idahoans could not afford to pay an energy bill ¹

Typical Residence

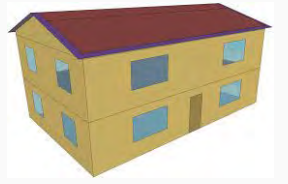


Typical Medium Office



RESIDENTIAL IMPACTS

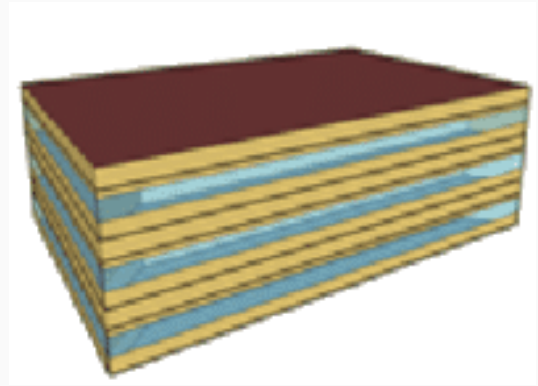
Typical Residence



- A house in Idaho's Southwest that has an Air Change per Hour (ACH) of 5 vs an ACH of 3 pays an **additional \$75 per year in utilities.**
- A house with 7ACH would pay an additional \$153 per year vs a house with a 3ACH tight envelope.
- The cost to do blower door and duct tightness testing is about \$150 per house. Since Idaho's current amendments only require this to be done for 1 of 5 homes, this cost ends up closer to \$30 per home, resulting in **a payback of 6 months or less to ensure that homes stay at an ACH of 3 vs an ACH of 5.**
- These savings may be higher for houses in climate zone 6B or with different utilities and heating (for example it is much more expensive to heat with propane or electric resistance)
- This analysis considered ONLY changes in air-tightness, keeping every other parameter the same. It did not consider the impact of duct tightness, lighting efficiencies, or mechanical equipment efficiencies all of which are also slated for removal.

COMMERCIAL IMPACTS

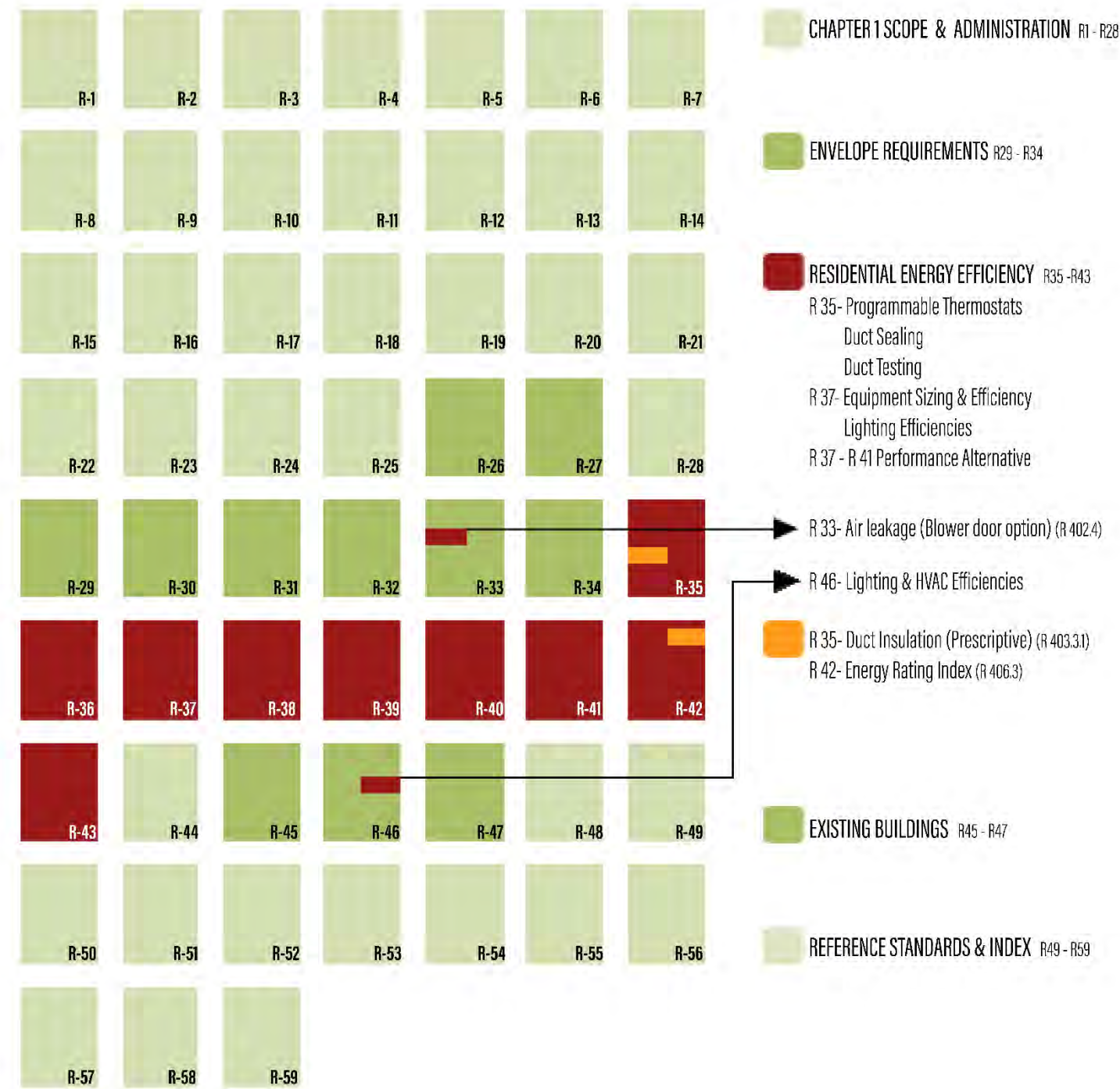
Typical Medium Office



- Removing the ventilation controls, daylight controls, and assuming slightly (10%) less efficient lighting and equipment results in an additional annual cost to the building owner of **\$2,285 per year in utilities.**
- Removing programmable controls and economizers (which until last week were also slated for removal), would have cost an additional **\$2,097 per year in utilities.**
- It is difficult to know the full impact of removing all minimum fan, HVAC, water heating, and lighting efficiencies. While US manufacturers have minimum requirements, overseas equipment could be installed that could be far less efficient. A conservative estimate of 10% increased inefficiency was used for this analysis.

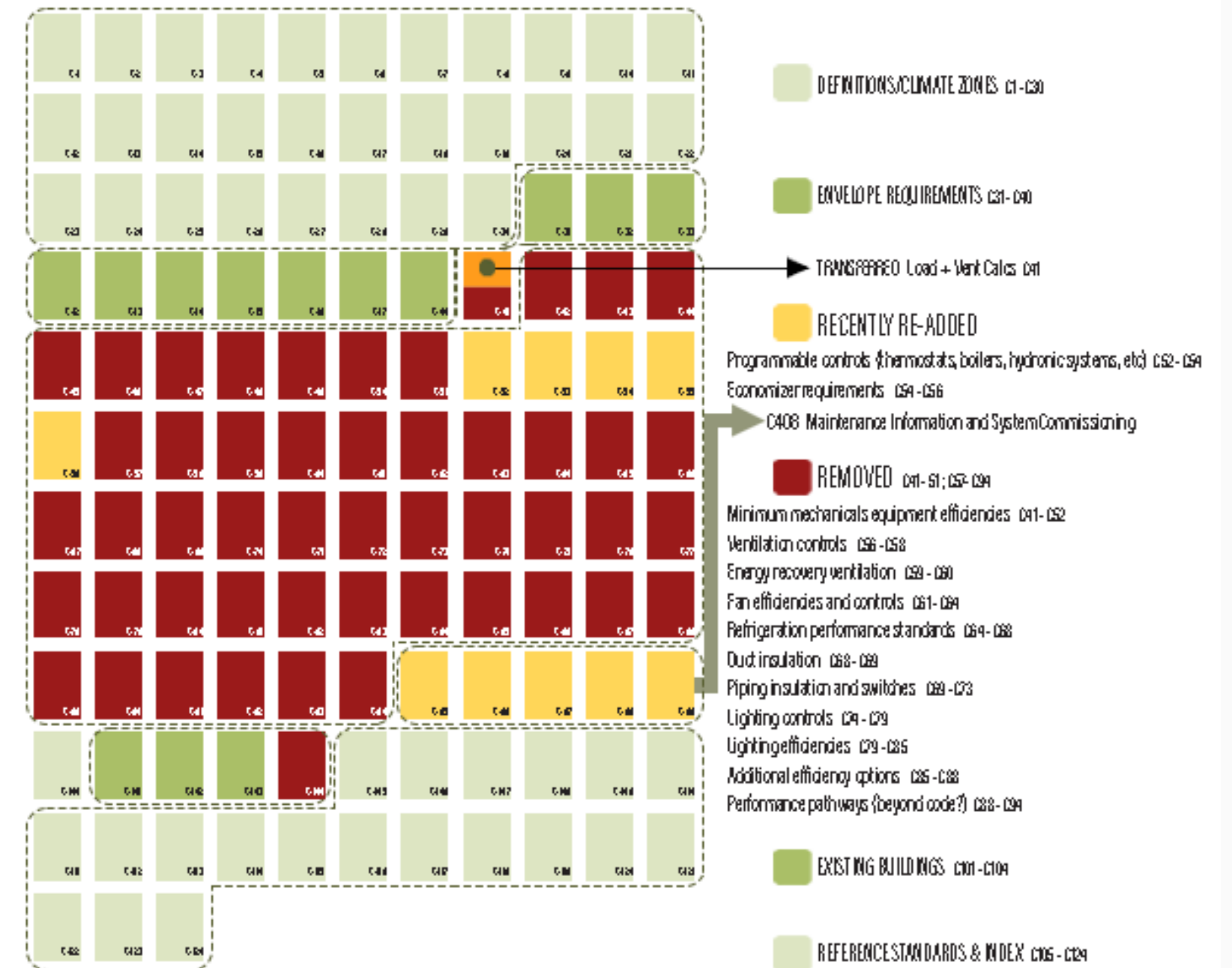
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REVISIONS TO IECC 2018 COMMERCIAL CODE

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- Initially deleted, recently re-added provisions
- Code provisions set to be deleted





VIRUS MITIGATION

ENERGY IMPACTS OF IAQ INTERVENTIONS

“We don’t drink contaminated water. Why do we tolerate breathing contaminated air?”



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The Atlantic

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HEALTH

The Plan to Stop Every Respiratory Virus at Once

The benefits of ventilation reach far beyond the coronavirus. What if we stop taking colds and flus for granted, too?

By Sarah Zhang



Shira Inbar

<https://www.visualcapitalist.com/safe-spaces-why-indoor-air-quality-has-never-mattered-more/>



Public Health Guidance:

- “Follow all current regulatory and statutory requirements and recommendations”

• Ventilation, Filtration, Air Cleaning:

- Maintain outdoor airflow rates for ventilation up to or beyond code.
- Merv-13 or better
- Only use air cleaners with clear evidence of effectiveness and safety
- Select control options that provide desired exposure reduction while minimizing energy penalties.

Air Distribution

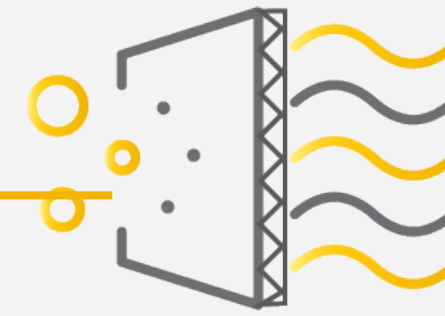
- Promotes air mixing without causing strong air currents

HVAC System Operation

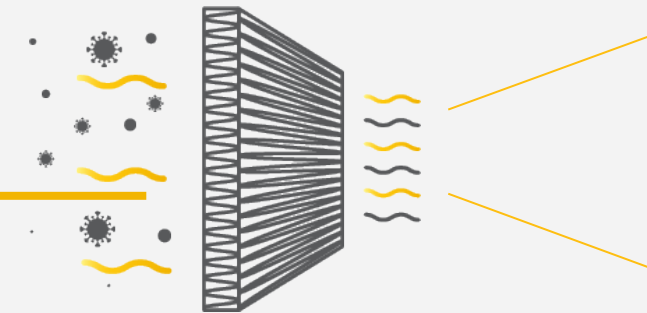
- Maintain temperature and humidity design setpoints
- Achieve three ach (air changes per hour) to flush space between occupancy periods.
- Limit re-entry of contaminated air.

ASHRAE Epidemic Task Force

MERV Filters



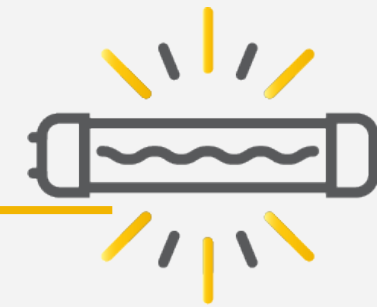
HEPA Filters



Portable

In-Duct

UV Light



Upper Room

In-Duct

Ionization



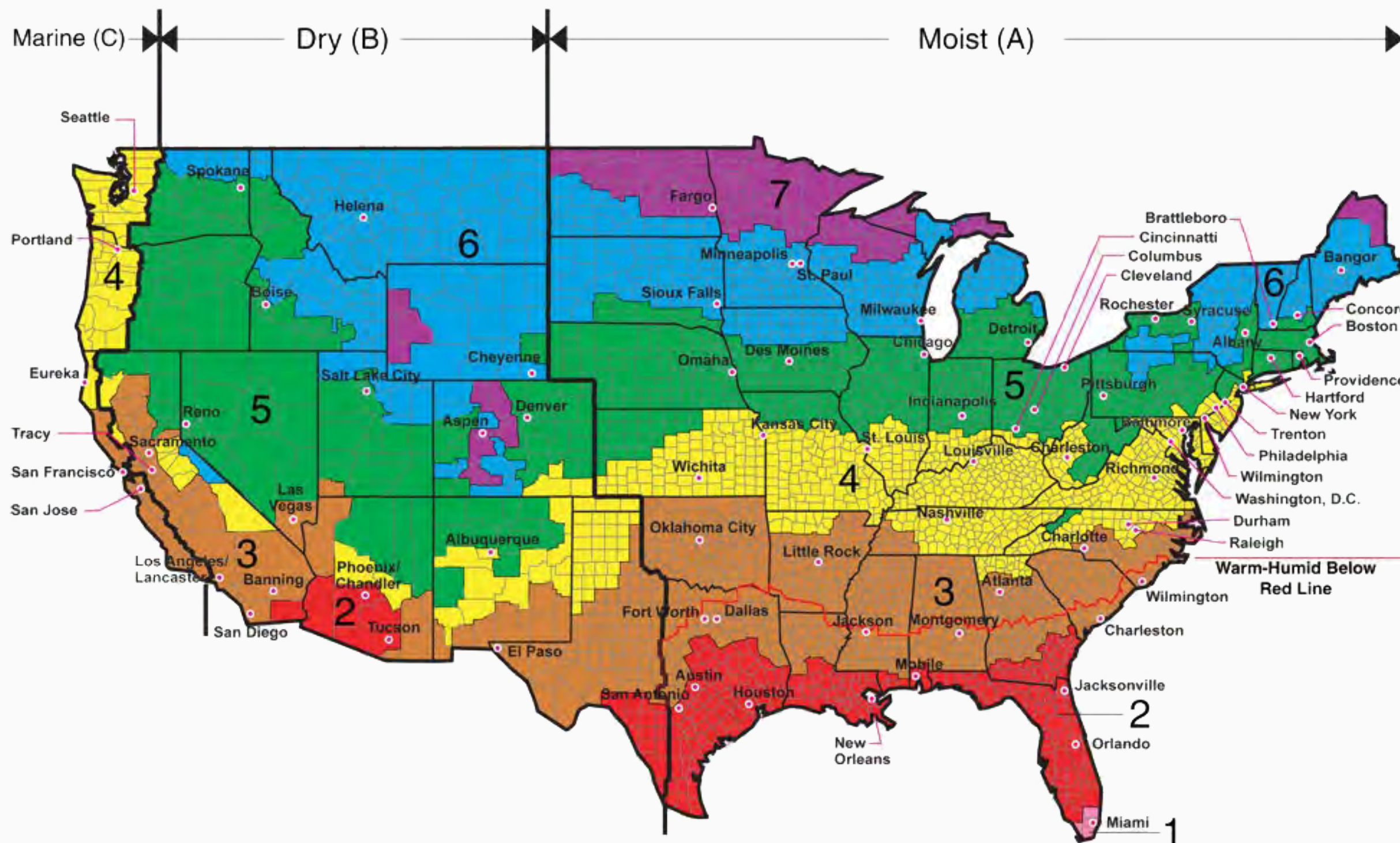
Outdoor Air



100% OA

3 ach





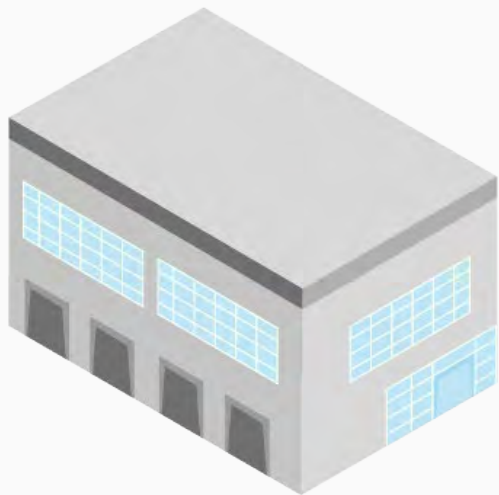
High-Rise Apartment	Mid-Rise Apartment	Large Hotel	Small Hotel
Primary School	Secondary School	Fast Food	Strip Mall
Standalone Retail	Warehouse	Small Office	Medium Office
	Large Office	Hospital	

All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

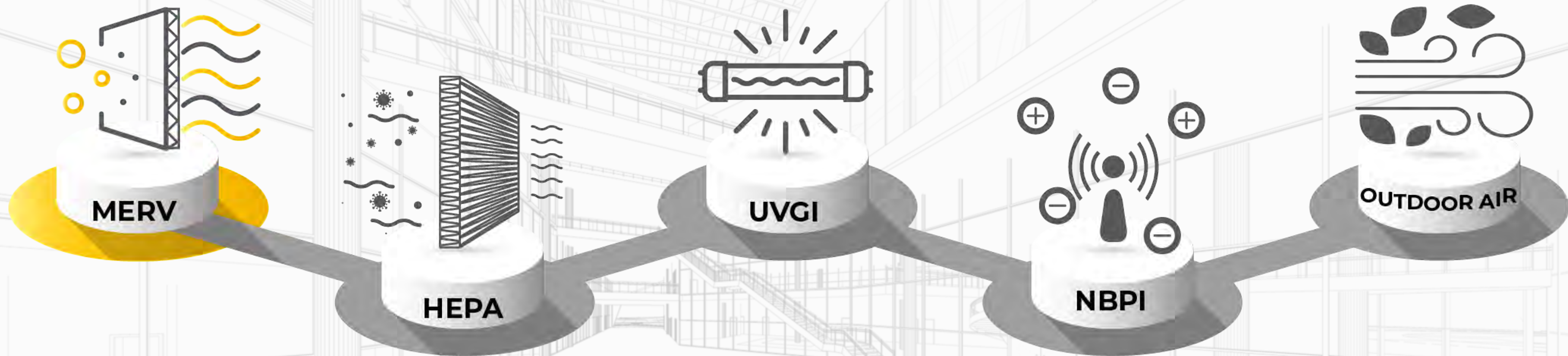
Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

DOE COMMERCIAL BUILDING PROTOTYPES

Building Type	Square Footage	Number of Stories	Heating	Cooling	Air Distribution	Systems
Medium Office	53600	3	Furnace	PACU	MZ	3
Stand-Alone Retail	24695	1	Furnace	PACU	ZN PSZ-AC	4
Secondary School	210900	2	Boiler	Air Cooled Chiller	MZ VAV	5 CAV, 4 VAV
Hospital	241410	5	Boiler	Water Cooled Chiller	CAV + VAV	2 VAV
Large Hotel	122132	6	Boiler	Air Colled Chiller	DOAS + VAV	2
Warehouse	49495	1	Furnace	PACU	ZN HVAC	2
Full-Service Restaurant	5502	1	Furnace	PACU	ZN PSZ-AC	2
Mid-Rise Apartment	33700	4	Furnace	Split System DX (1 per apt)	SAC	24



MEDIUM EFFICIENCY REPORTING VALUE



1

Increase Pressure Drop
across Fans by
0.4 inH₂O

The image displays two screenshots of the EnergyPlus software interface, showing HVAC system diagrams and the properties of OS:Fan:VariableVolume objects. The top diagram shows a single fan loop, and the bottom diagram shows a multi-zone system with two fans. Yellow arrows point from the fan components in the diagrams to the 'Pressure Rise' field in the properties panel, which is highlighted with a yellow box. The 'Pressure Rise' value is 5.580000000000001 inH₂O for the top fan and 5.9000000000000004 inH₂O for the bottom fan.

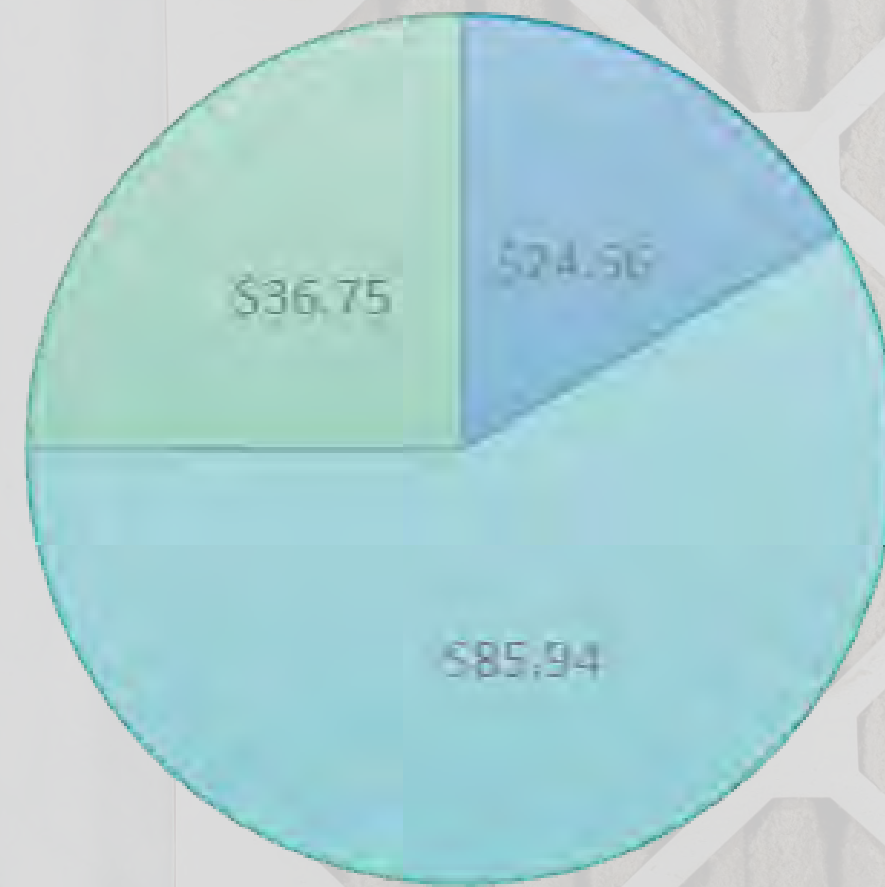
Property	Top Fan (5 Zone PVAV Fan)	Bottom Fan (5 Zone PVAV Fan)
Name	5 Zone PVAV Fan	5 Zone PVAV Fan
Availability Schedule Name	Always On Discrete	Always On Discrete
Fan Total Efficiency	0.6045000000000004	0.6045000000000004
Pressure Rise	5.580000000000001 inH ₂ O	5.9000000000000004 inH ₂ O
Maximum Flow Rate	Autosized	Autosized
Fan Power Minimum Flow Rate Input Method	Fraction	Fraction
Fan Power Minimum Flow Fraction	0.25	0.25
Fan Power Minimum Air Flow Rate	0 cfm	0 cfm
Motor Efficiency	0.9300000000000005	0.9300000000000005



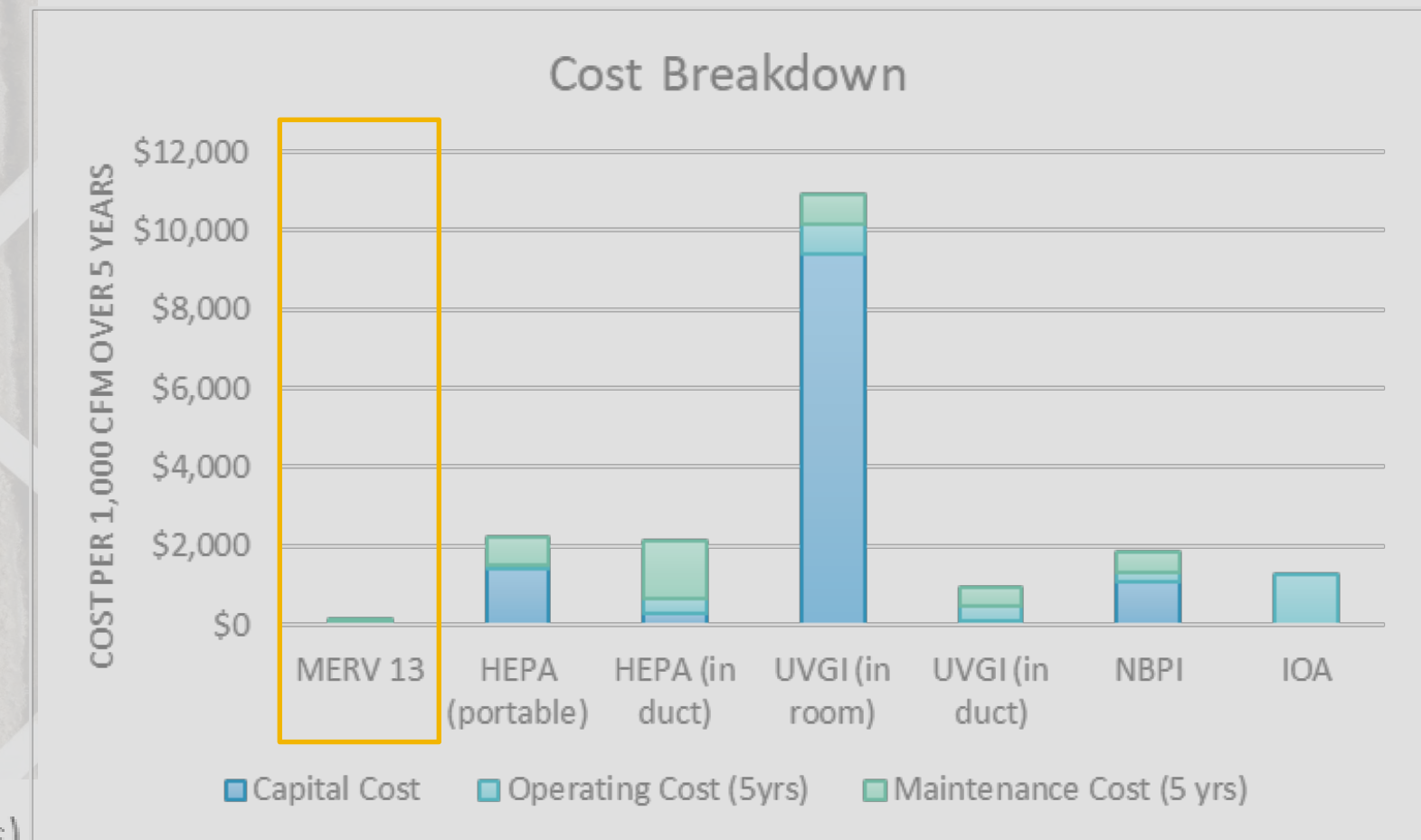
[1] MERV filter drop of 0.4" H₂O: From ASHRAE Standard 90.1 Table 6.5.3.1-2 "Fan Power Limitation Pressure Drop Adjustment"

Upgrading from MERV 7 to MERV 13

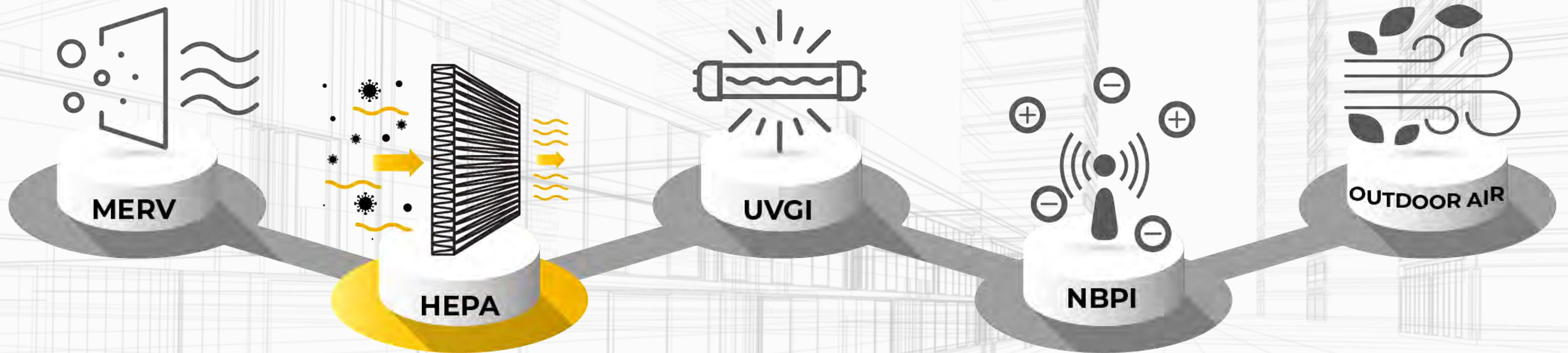
MERV FILTRATION

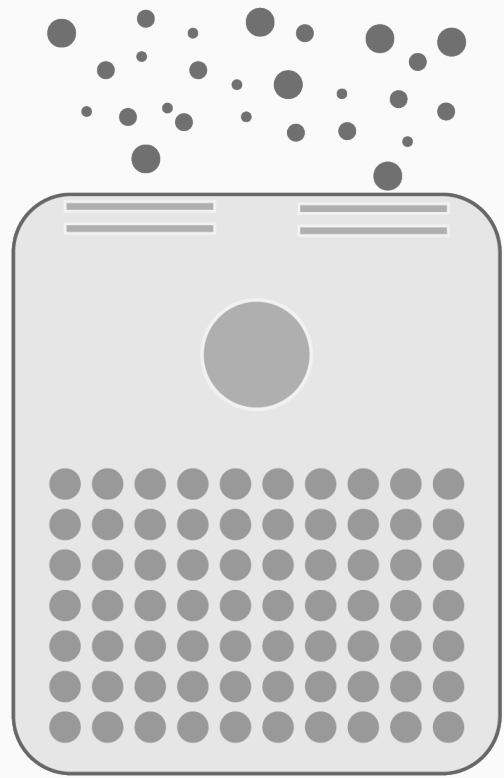


■ Capital Cost ■ Operating Cost (5yrs) ■ Maintenance Cost (5 yrs)



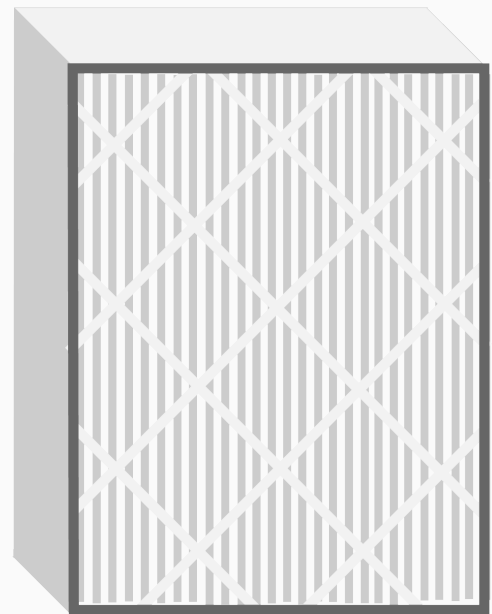
HIGH EFFICIENCY PARTICULATE AIR





P
O
R
T
A
B
L
E

**H
E
P
A**



I
N
D
U
C
T

**M
E
R
V**

PROS

- Portable, “plug and play”
- More effective at filtering sub-micron and nanoparticles
- Can be moved to optimize effectiveness

CONS

- Floor space and outlets
- Noisy at high speeds
- Additional maintenance

-
- Single-point intervention. No extra space needed
 - Minimal change to maintenance requirements
 - Easy to install into existing HVAC systems

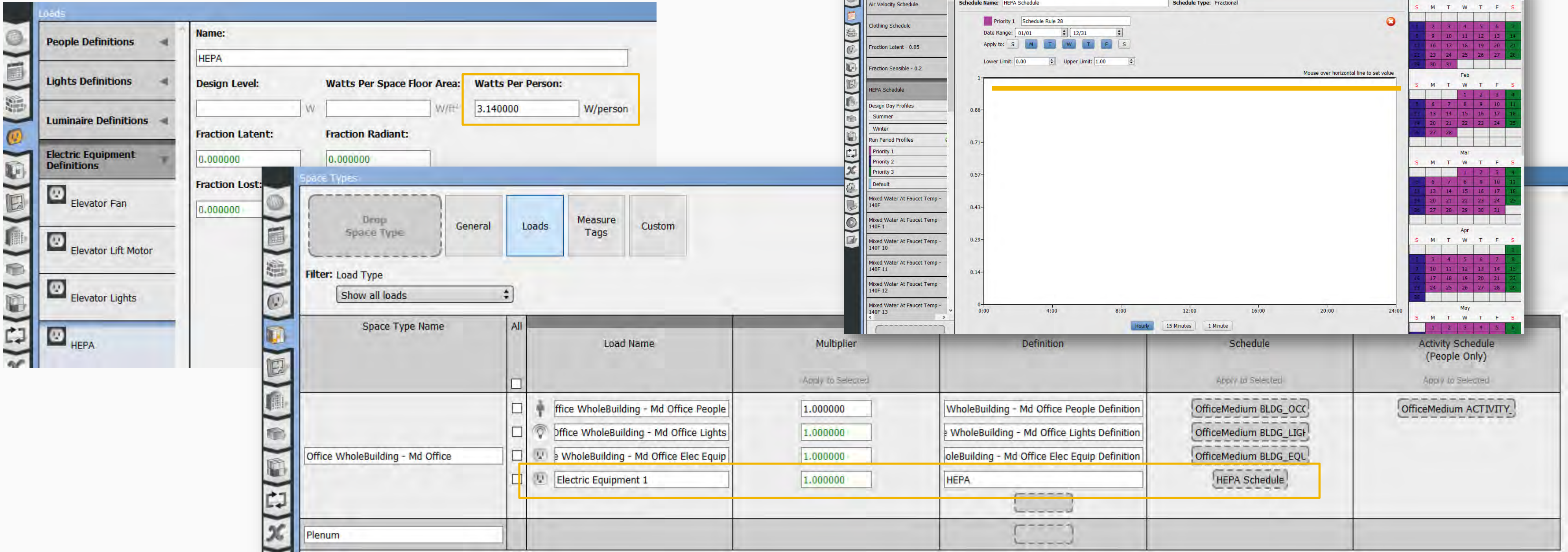
- Less effective at filtering sub-micron and nanoparticles.
- Effectiveness is limited by airflow

Portable HEPA

Model Parameters

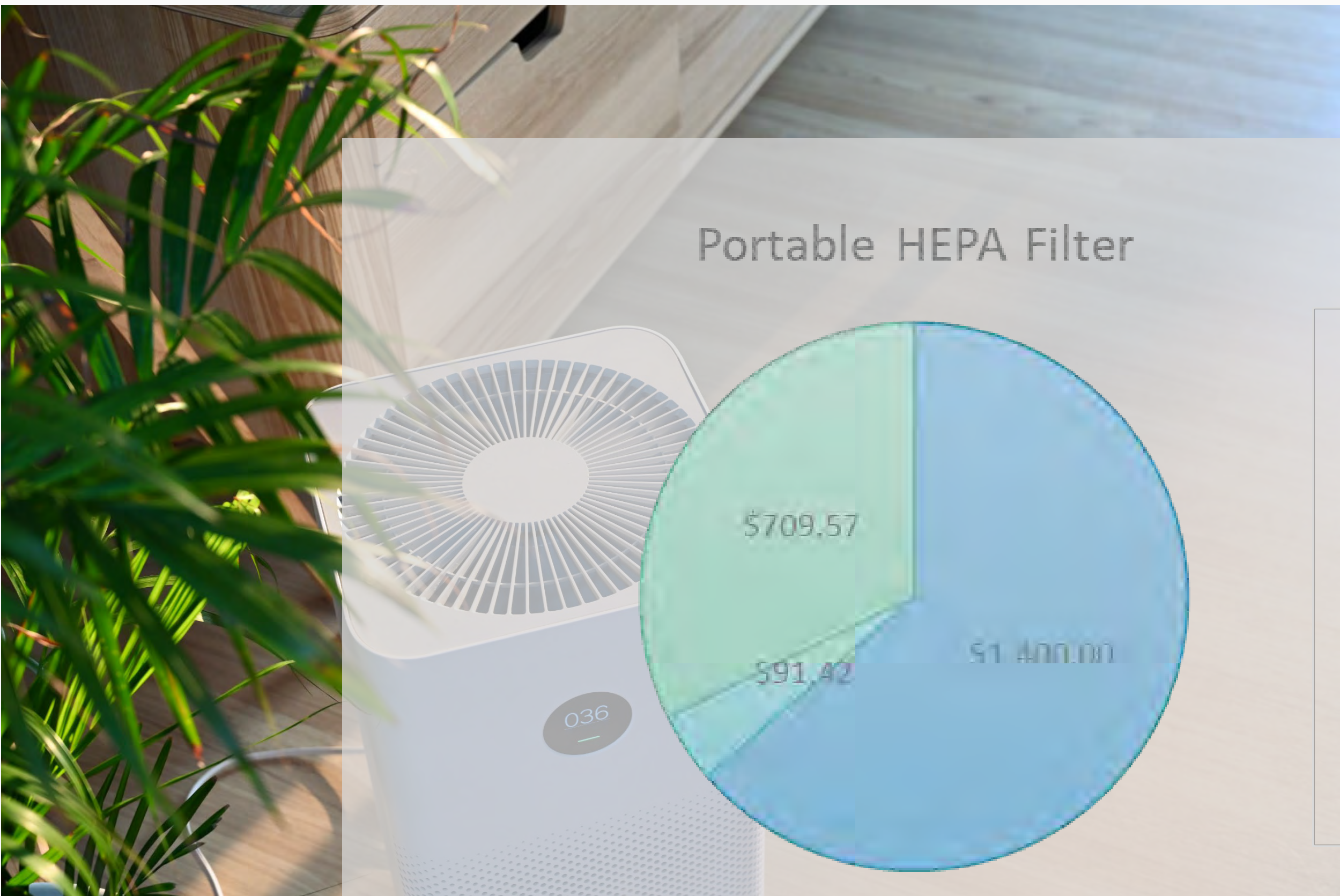
1 Plug Load:
3.14 W/person

3 Schedule: **Always on M-F**

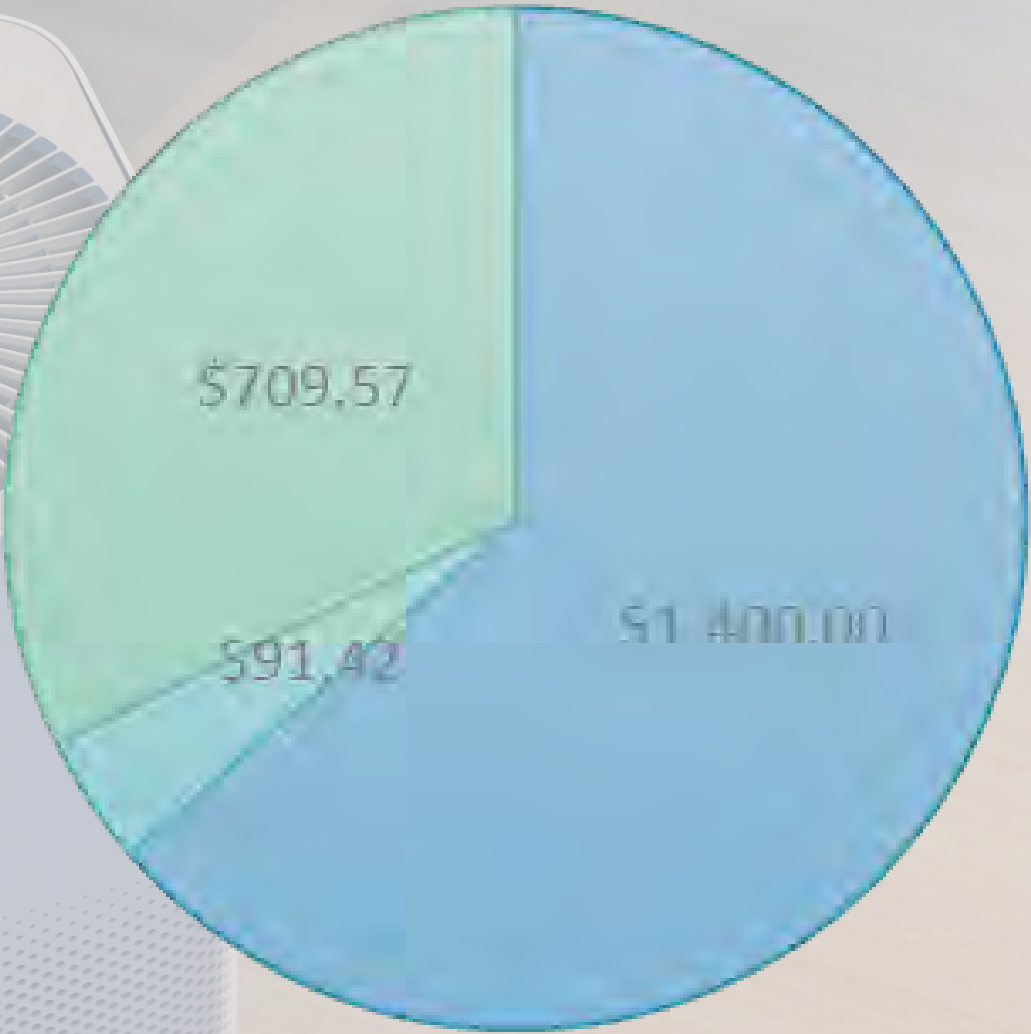


2 Space Type: **Whole Building**



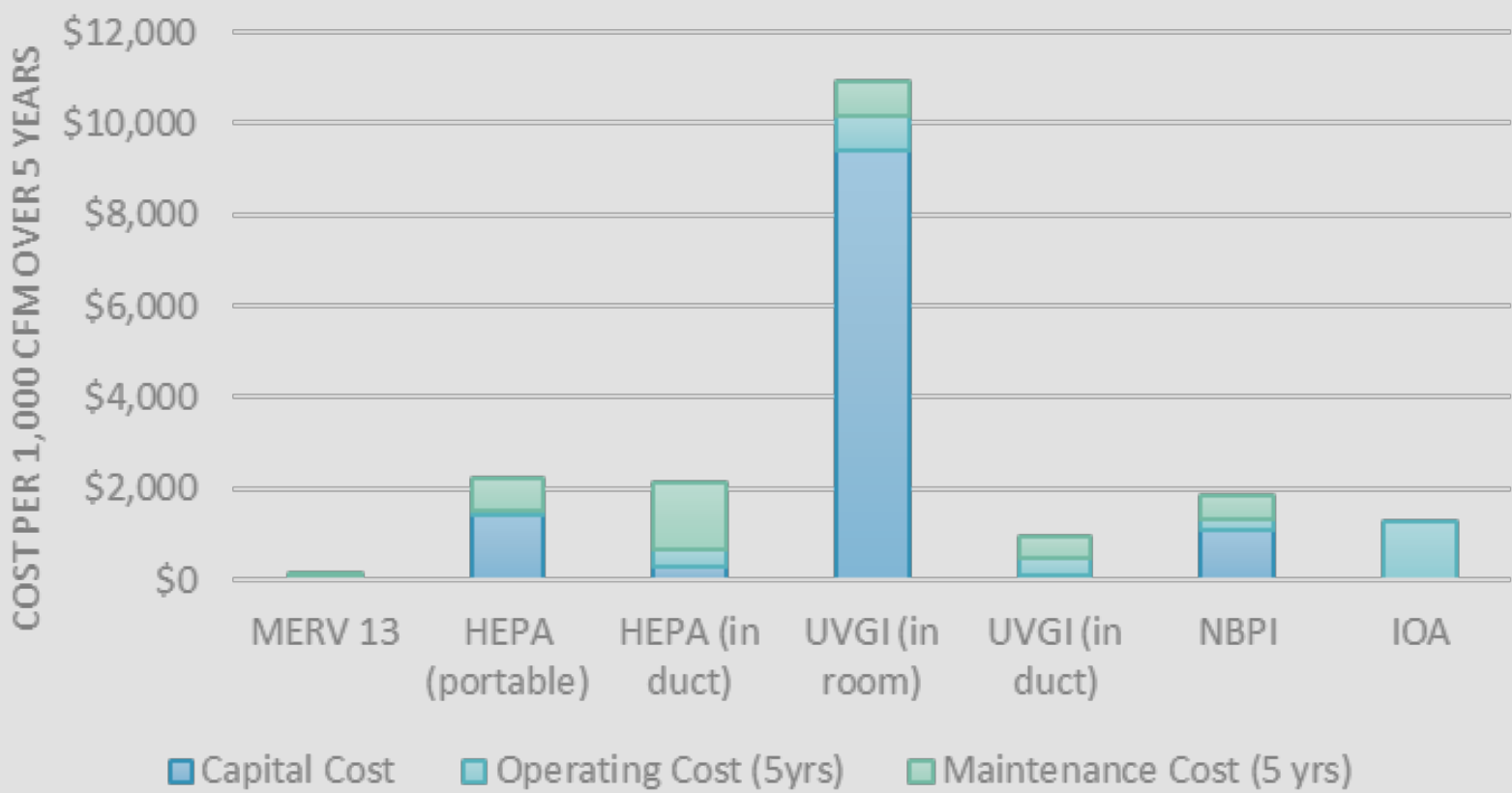


Portable HEPA Filter



Portable HEPA

Cost Breakdown



■ Capital Cost ■ Operating Cost (5yrs) ■ Maintenance Cost (5 yrs)

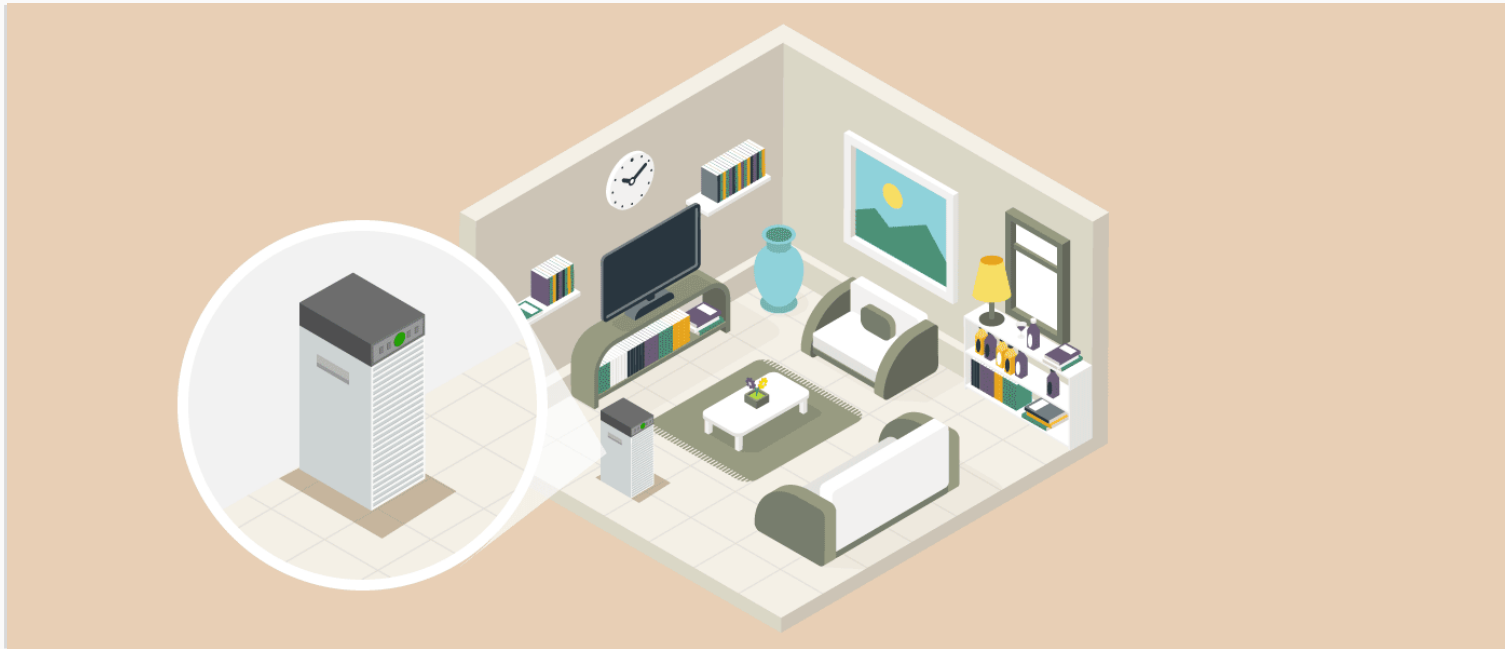
Portable HEPA

Design Guidelines



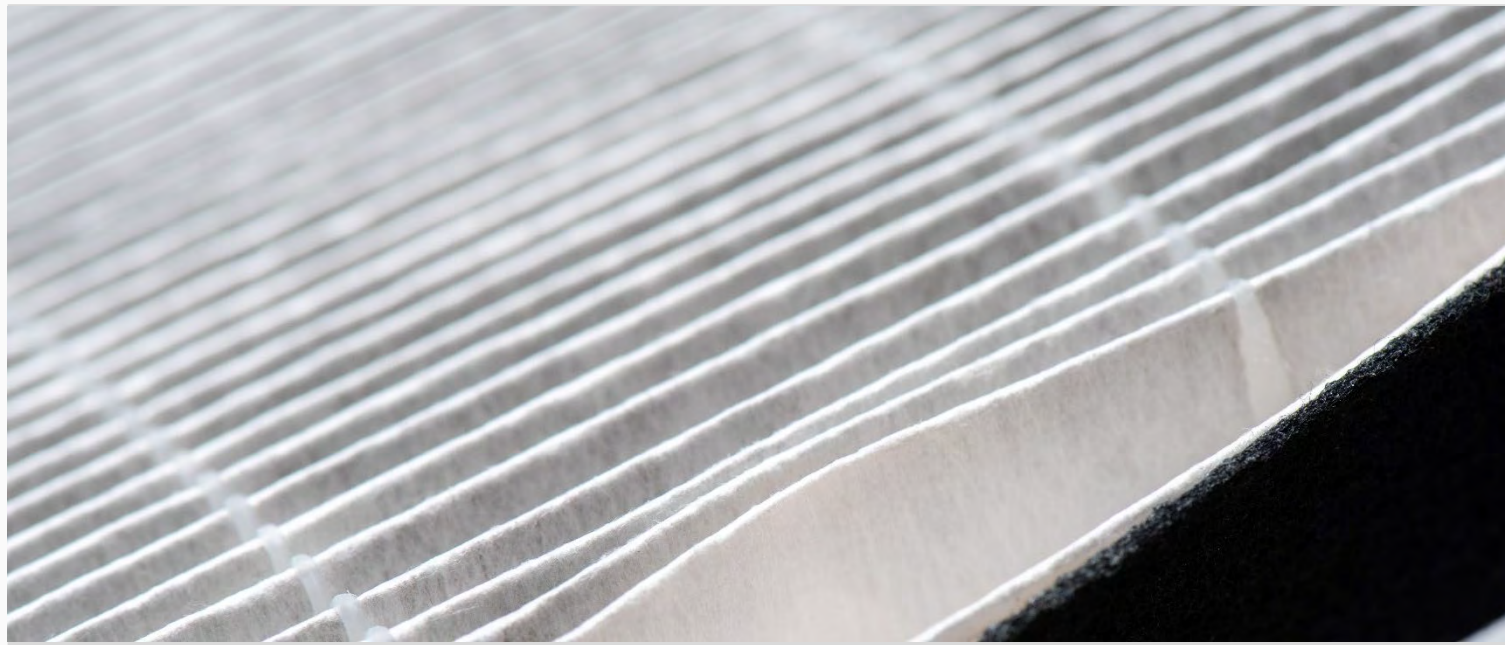
//

High CADR (Clean Air Delivery Rate)



//

Placement is key



//

Change Filters Regularly

In-Duct HEPA

Model Parameters

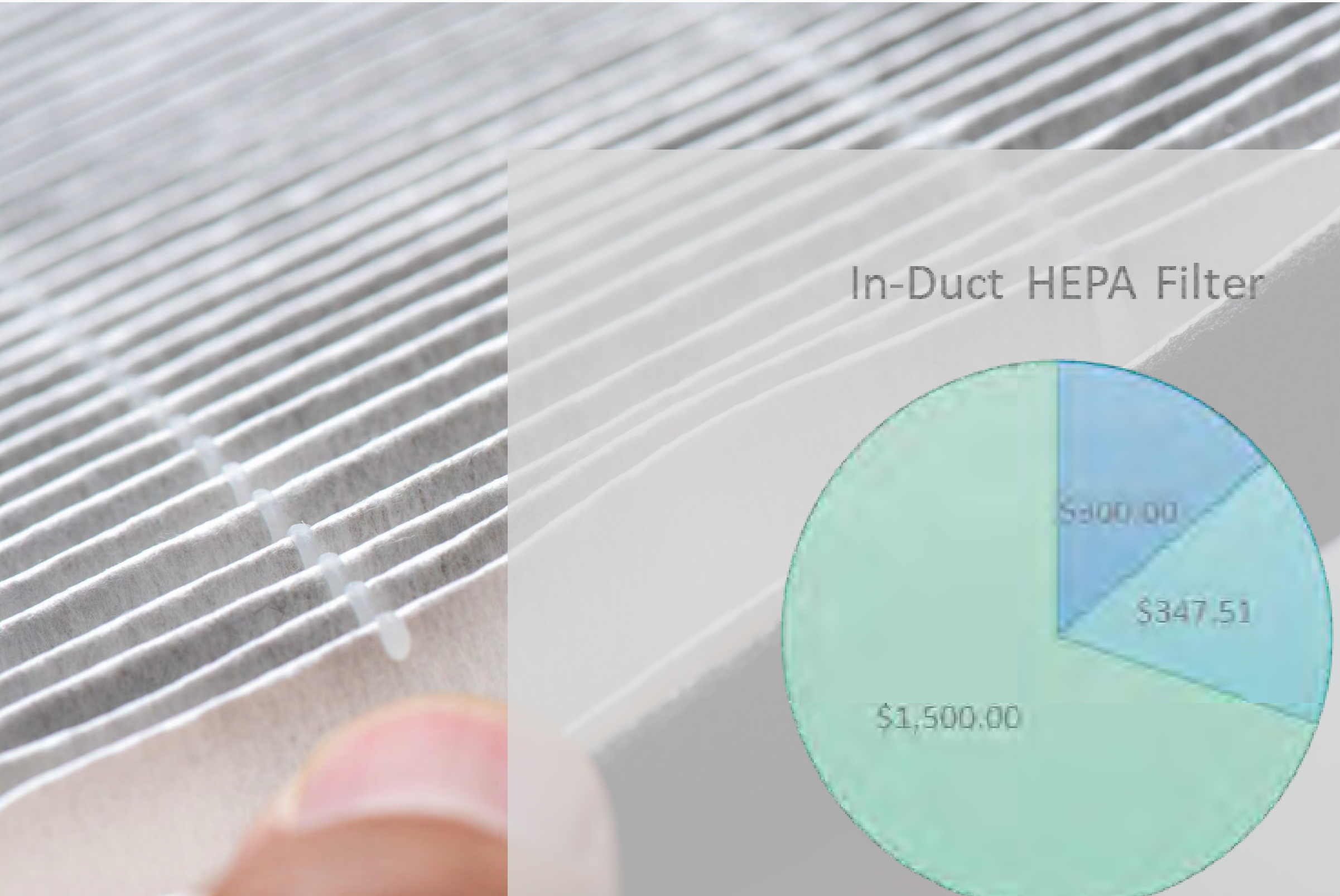
1

Increase Pressure Drop Across Fans by 1.25 inH₂O

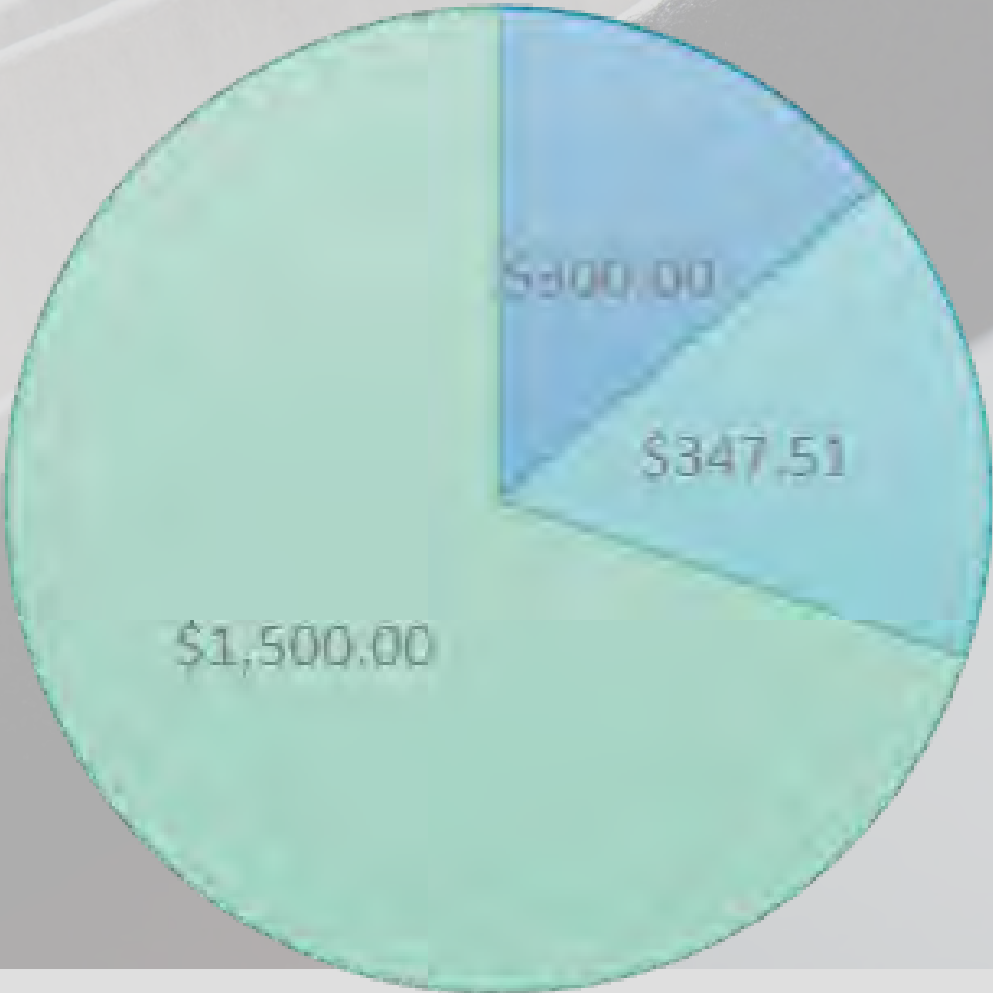
The screenshot displays the HVAC System software interface for a 5 Zone PAVV fan model. The interface is divided into two main sections: a schematic diagram and a properties panel. The schematic diagram shows a fan connected to a duct system with three zones. The properties panel on the right is titled 'OS:Fan:VariableVolume' and contains various parameters for the fan. The 'Pressure Rise' parameter is highlighted in yellow in both sections, with a value of 5.580000000000001 inH₂O in the top section and 6.849999999999996 inH₂O in the bottom section. A yellow arrow points from the text 'Increase Pressure Drop Across Fans by 1.25 inH₂O' to the 'Pressure Rise' parameter in the bottom section.

Parameter	Value
Name	5 Zone PAVV Fan
Availability Schedule Name	Always On Discrete
Fan Total Efficiency	0.6045000000000004
Pressure Rise	5.580000000000001 inH ₂ O
Maximum Flow Rate	Autosized
Fan Power Minimum Flow Rate Input Method	Fraction
Fan Power Minimum Flow Fraction	0.25
Fan Power Minimum Air Flow Rate	0 cfm
Motor Efficiency	0.9300000000000005
Motor In Airstream Fraction	1



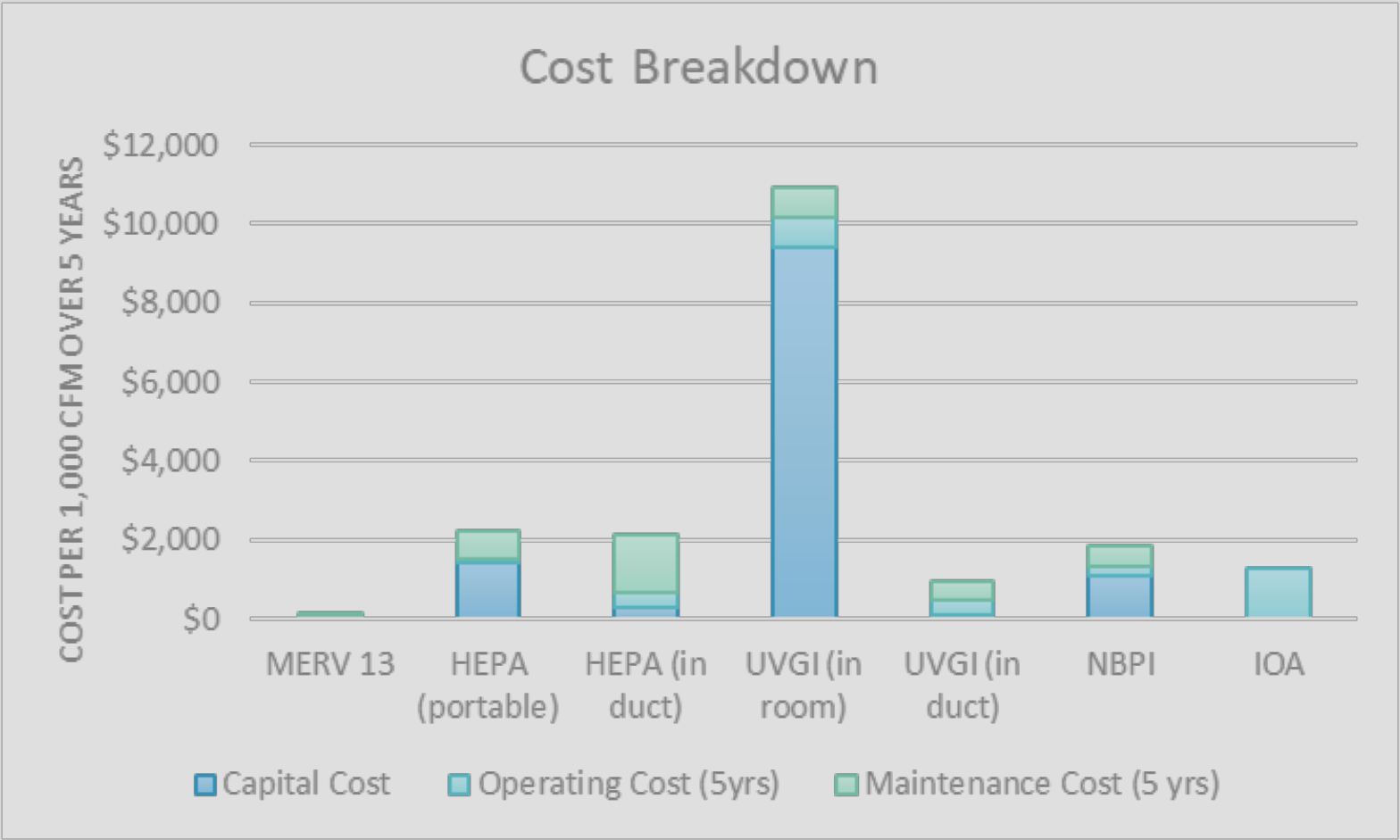


In-Duct HEPA Filter

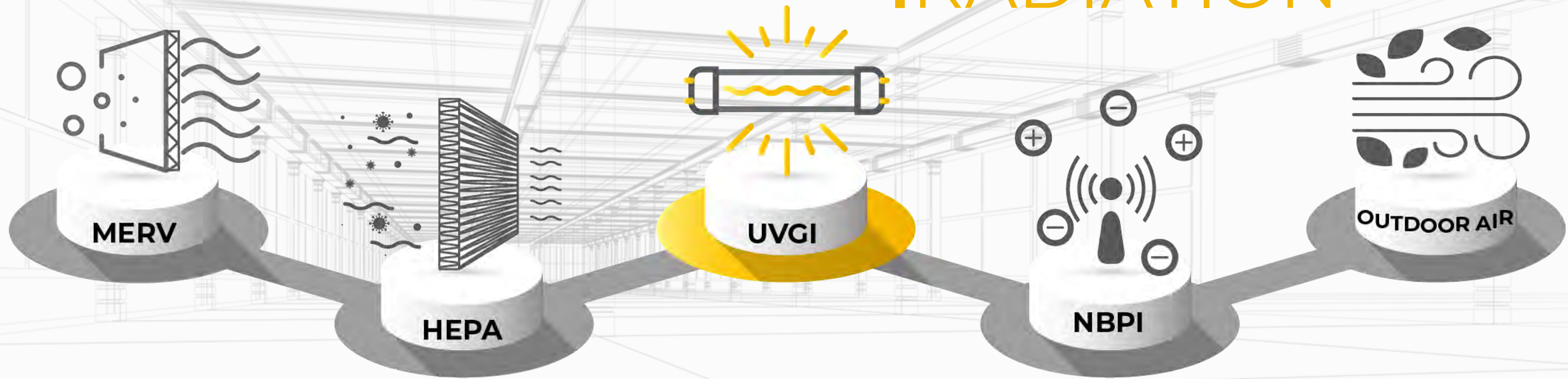


■ Capital Cost ■ Operating Cost (5yrs) ■ Maintenance Cost (5 yrs)

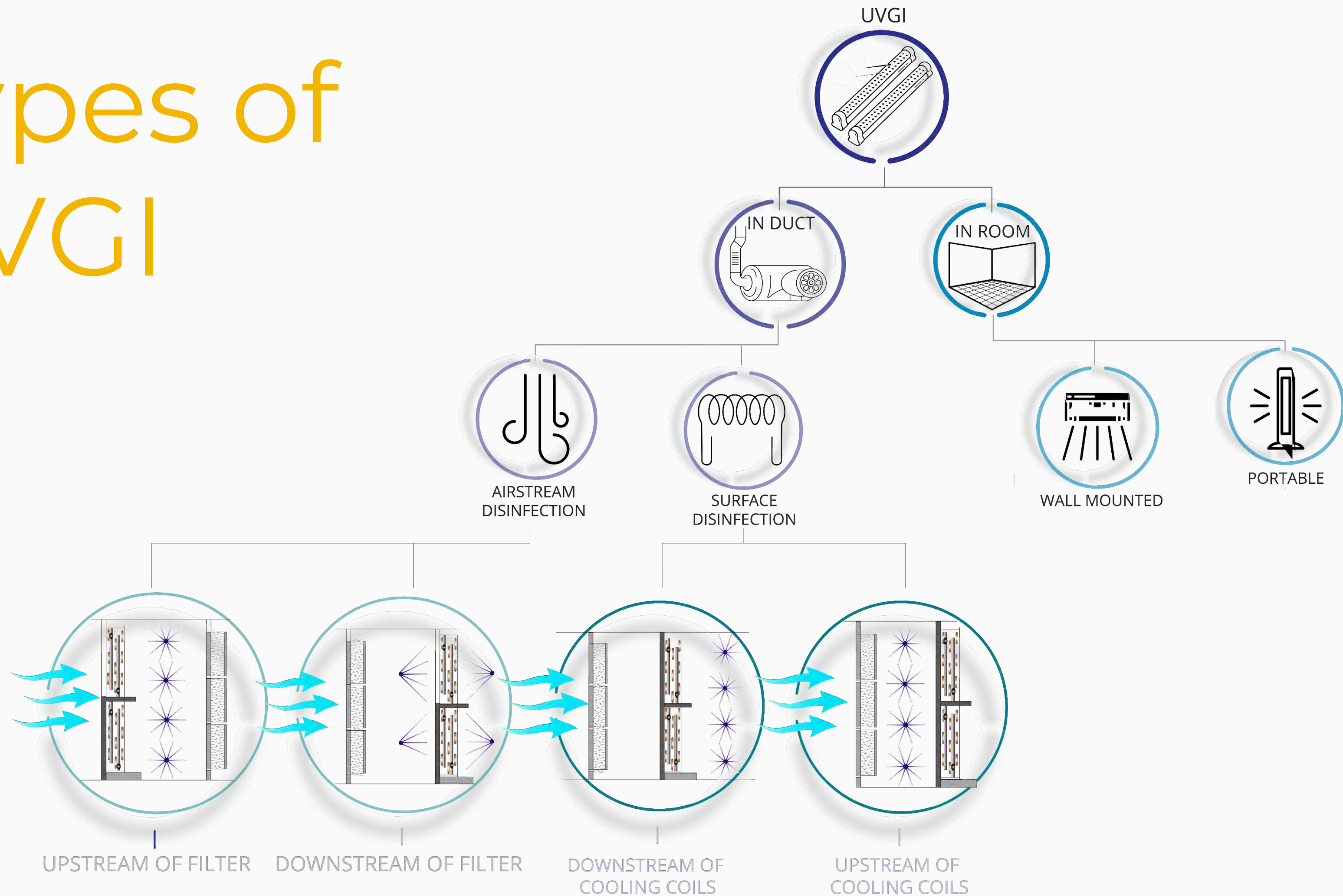
In-Duct HEPA



ULTRA VIOLET GERMICIDAL IRRADIATION



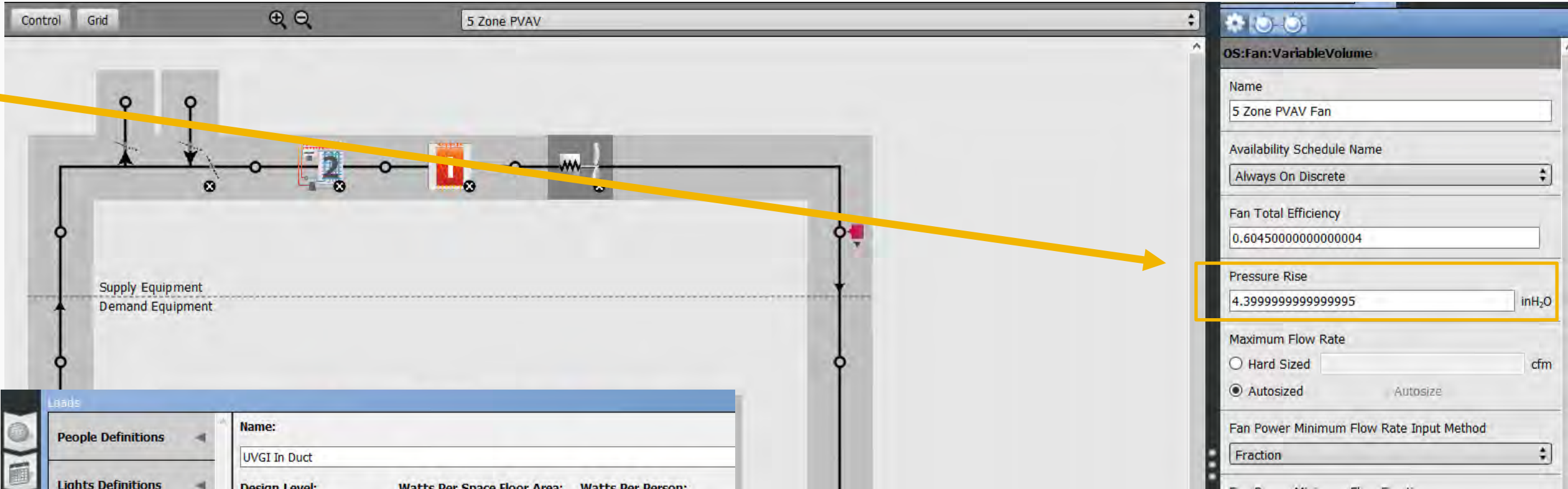
Types of UVGI



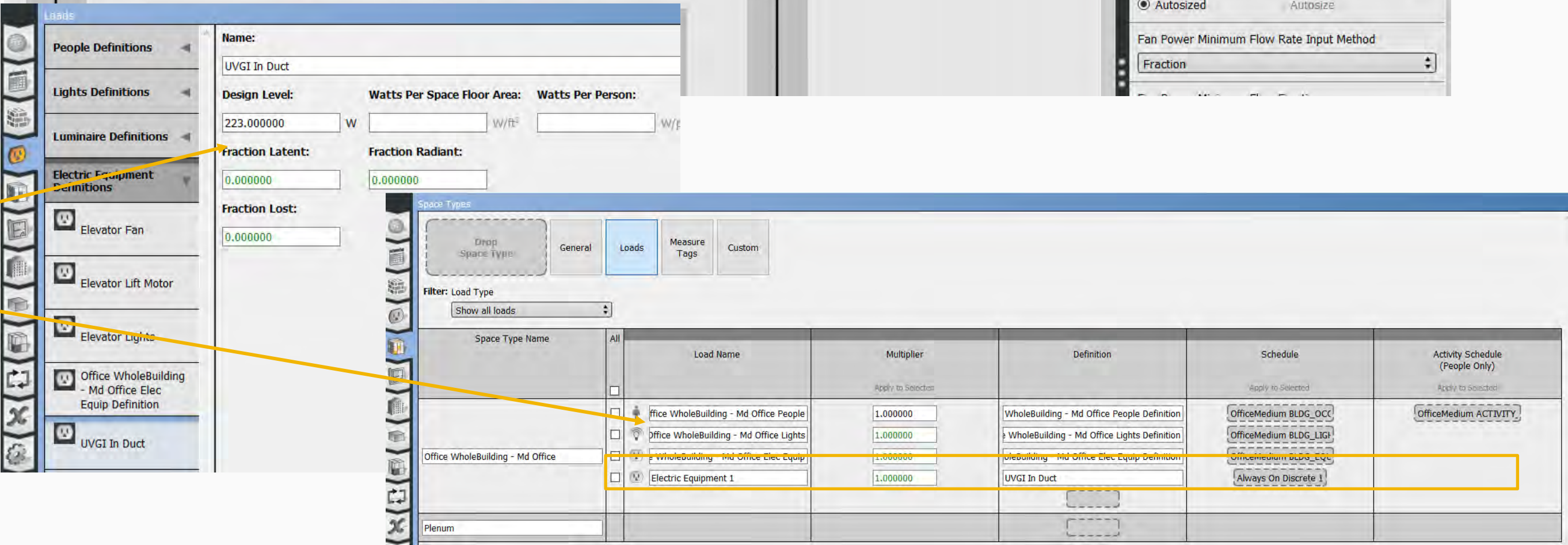
In-Duct UVGI

Model Parameters

1 20% Pressure Drop



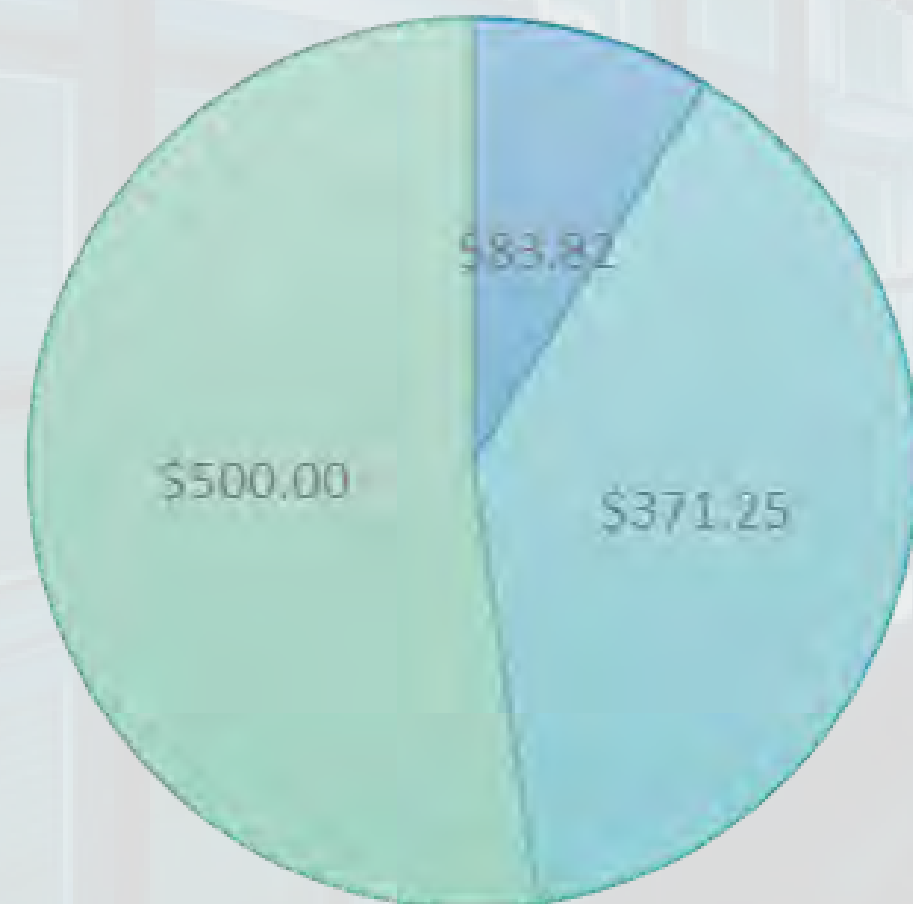
2 0.02 W/CFM Plug Load



[1] J Firrantello, W Bahnfleth "Simulation and Monetization of Collateral Airborne Infection Risk Improvements from Ultraviolet Germicidal Irradiation for Coil Maintenance", ASHRAE Science and Technology for the Built Environment (2018) 24, 135-148

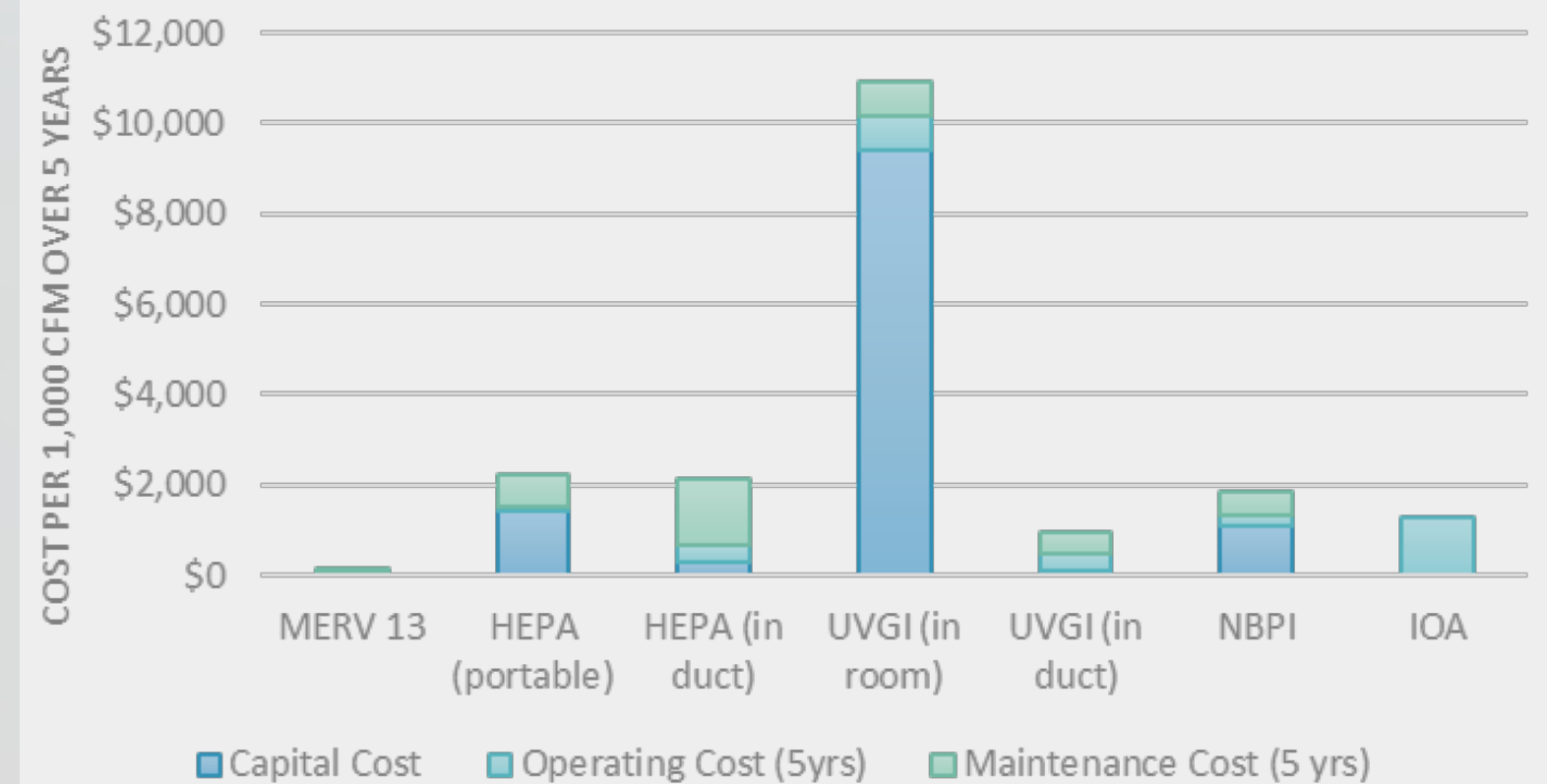
[2] J Luongo, J Brownstein, and SL Miller, "Ultraviolet Germicidal Coil Cleaning: Impact on Heat Transfer Effectiveness and Pressure Drop", Building and Environment(2107), 112, pp159-165

In-Duct UVGI

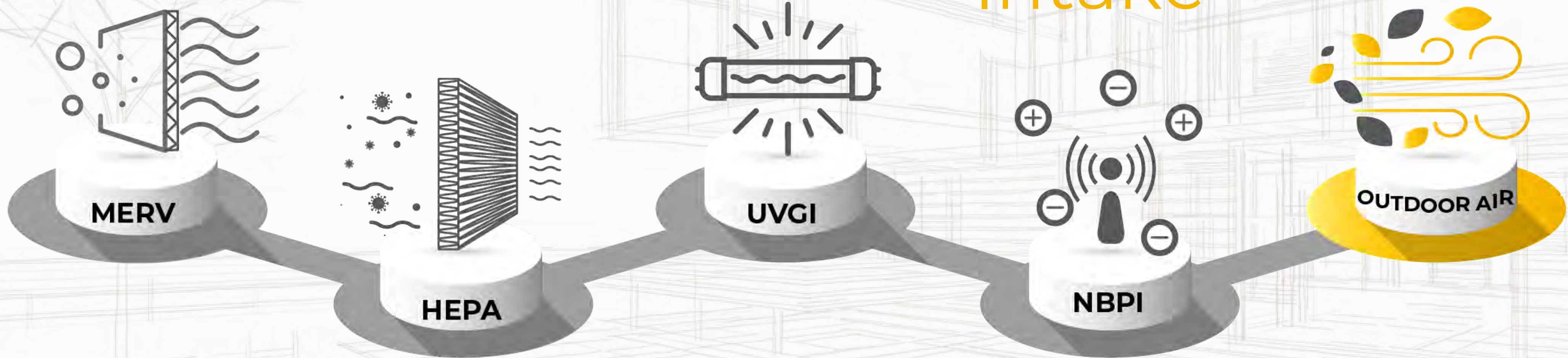


■ Capital Cost ■ Operating Cost (5yrs) ■ Maintenance Cost (5 yrs)

Cost Breakdown



Increase Outdoor Air Intake



Ventilation

// Ventilation needs to be clarified to mean ventilation with outdoor air. We dilute contaminants indoors by bringing in outdoor air that's virus-free.

-Bahnfleth

//



1 Increase O.A.
to 3 ach

The image displays two screenshots of the HVAC Systems software interface, illustrating the configuration of an outdoor air (O.A.) system. The top screenshot shows the initial state, and the bottom screenshot shows the updated state after increasing the O.A. to 3 ach.

Top Screenshot (Initial State):

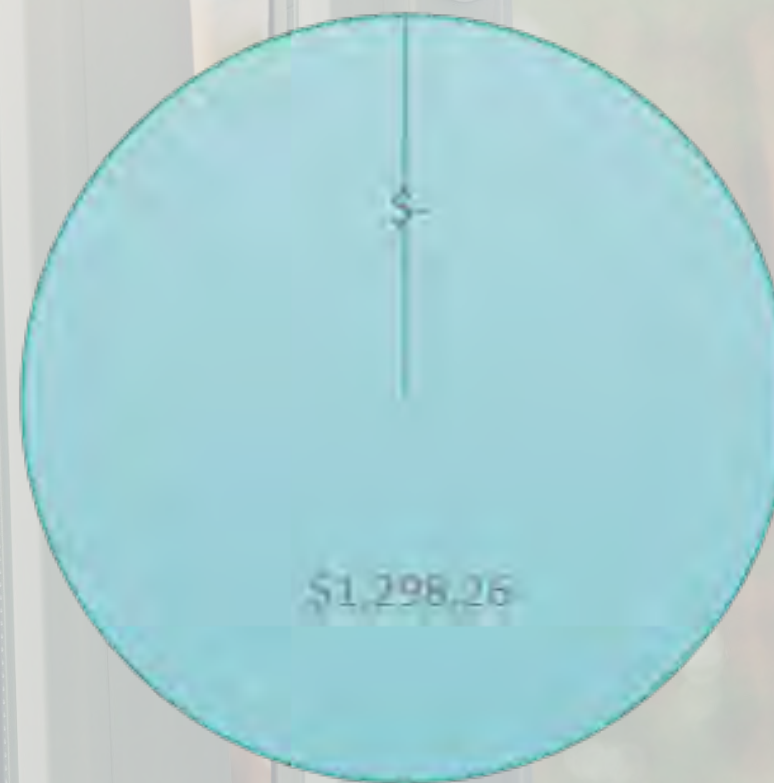
- OS:AirLoopHVAC:OutdoorAirSystem**
 - Name: 5 Zone PVAV OA System
 - OS:Controller:OutdoorAir**
 - Name: Controller Outdoor Air 1
 - Minimum Outdoor Air Flow Rate:
 - ☒ Hard Sized: 0 cfm
 - ☐ Autosized: Autosize
 - Maximum Outdoor Air Flow Rate:
 - ☐ Hard Sized: cfm
 - ☒ Autosized: Autosize
 - Economizer Control Type: DifferentialDryBulb
 - Economizer Control Action Type: ModulateFlow

Bottom Screenshot (Updated State):

- OS:AirLoopHVAC:OutdoorAirSystem**
 - Name: 5 Zone PVAV OA System
 - OS:Controller:OutdoorAir**
 - Name: Controller Outdoor Air 1
 - Minimum Outdoor Air Flow Rate:
 - ☒ Hard Sized: 160883.99999999997 cfm
 - ☐ Autosized: Autosize
 - Maximum Outdoor Air Flow Rate:
 - ☒ Hard Sized: 160883.99999999997 cfm
 - ☐ Autosized: Autosize
 - Economizer Control Type: DifferentialDryBulb

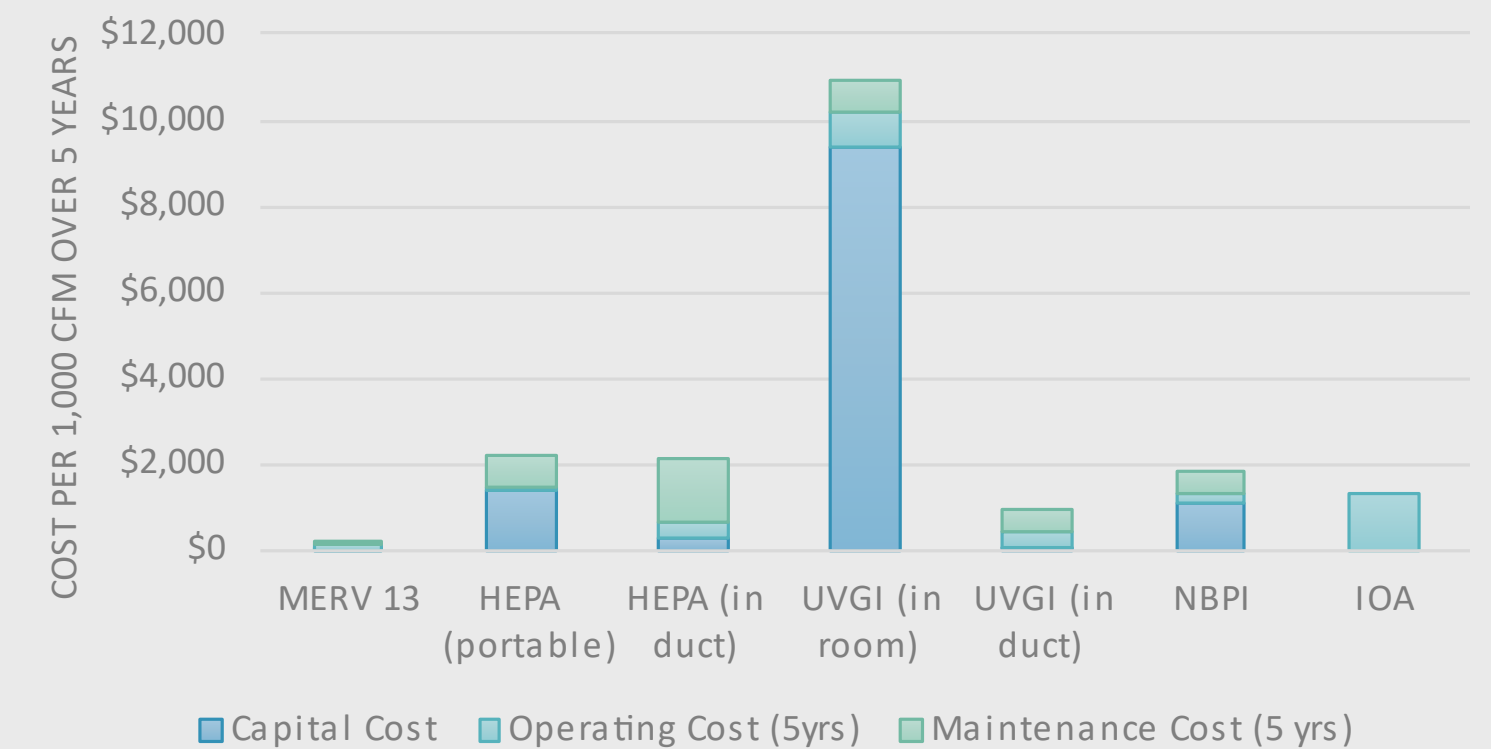
Yellow arrows indicate the change in the Minimum Outdoor Air Flow Rate from 0 cfm to 160883.99999999997 cfm, which corresponds to the increase in O.A. to 3 ach.

Increasing Outdoor Air Intake



■ Capital Cost ■ Operating Cost (5yrs) ■ Maintenance Cost (5 yrs)

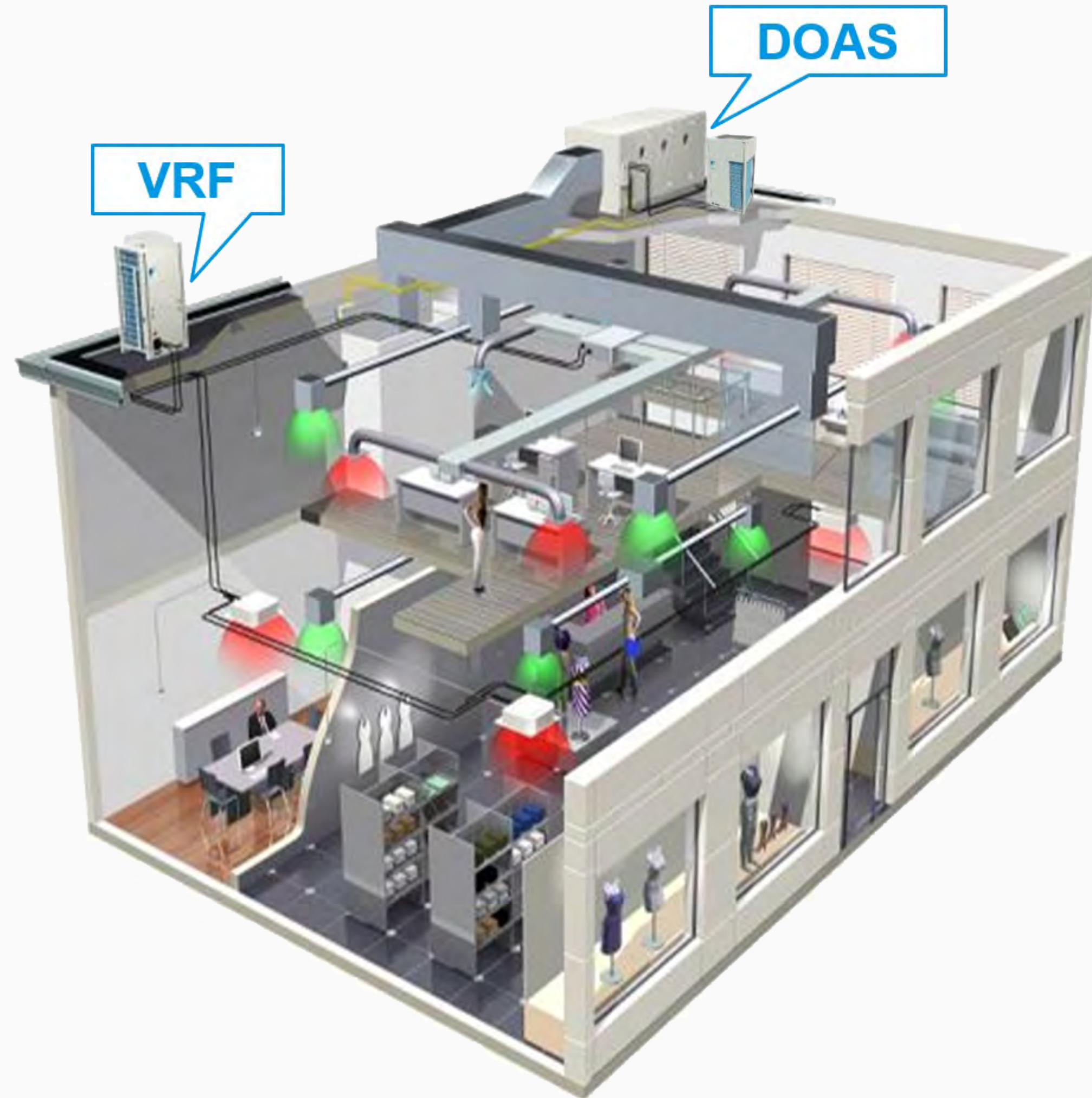
Cost Breakdown



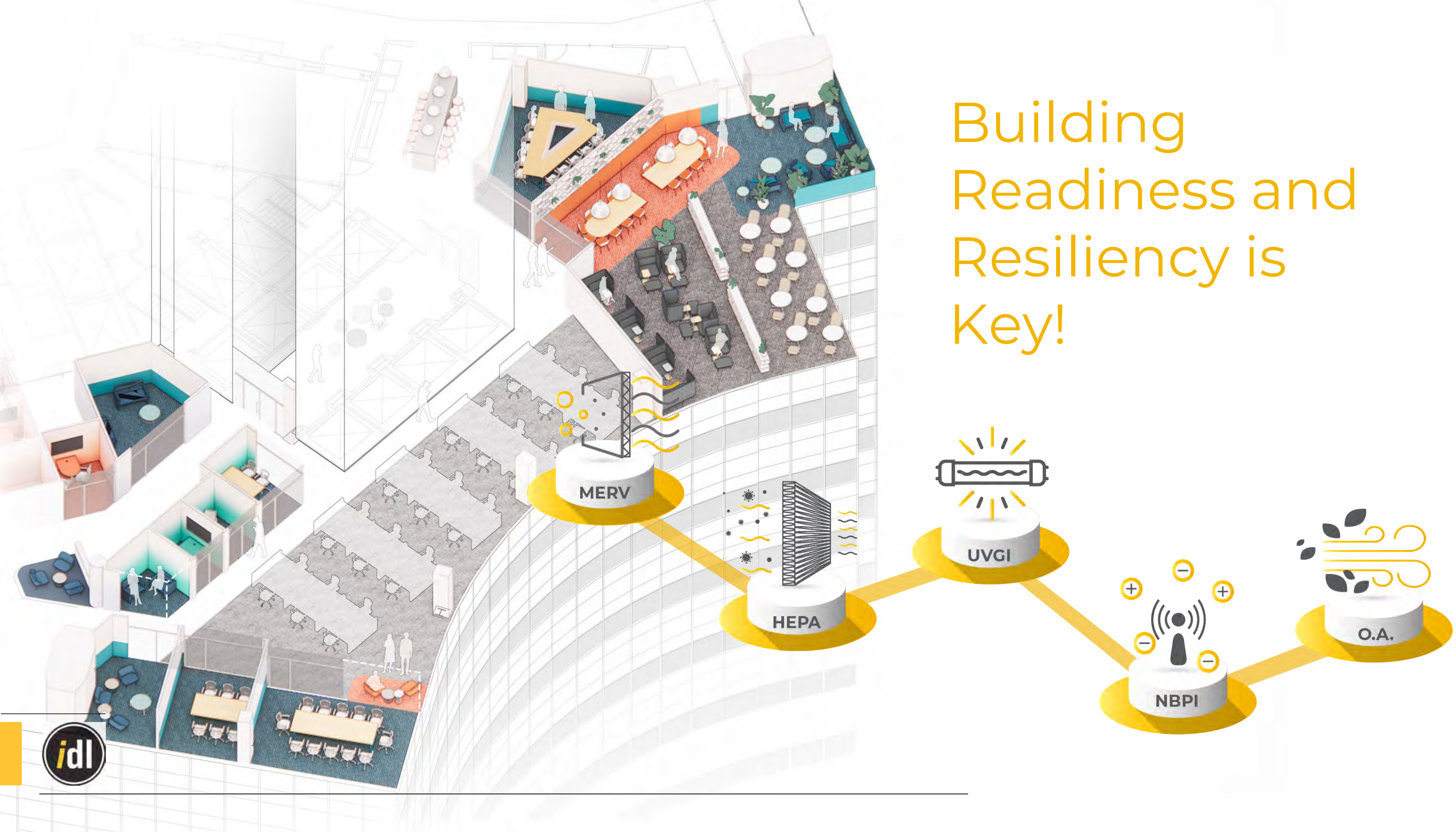
IOA

Design Guidelines

- // Maintain humidity between 40-60%
- // Maintain a clean cooling coil to increase heat transfer capabilities
- // Flush spaces for a duration sufficient to reduce airborne particle by 95% (3-6 ach)



Building Readiness and Resiliency is Key!

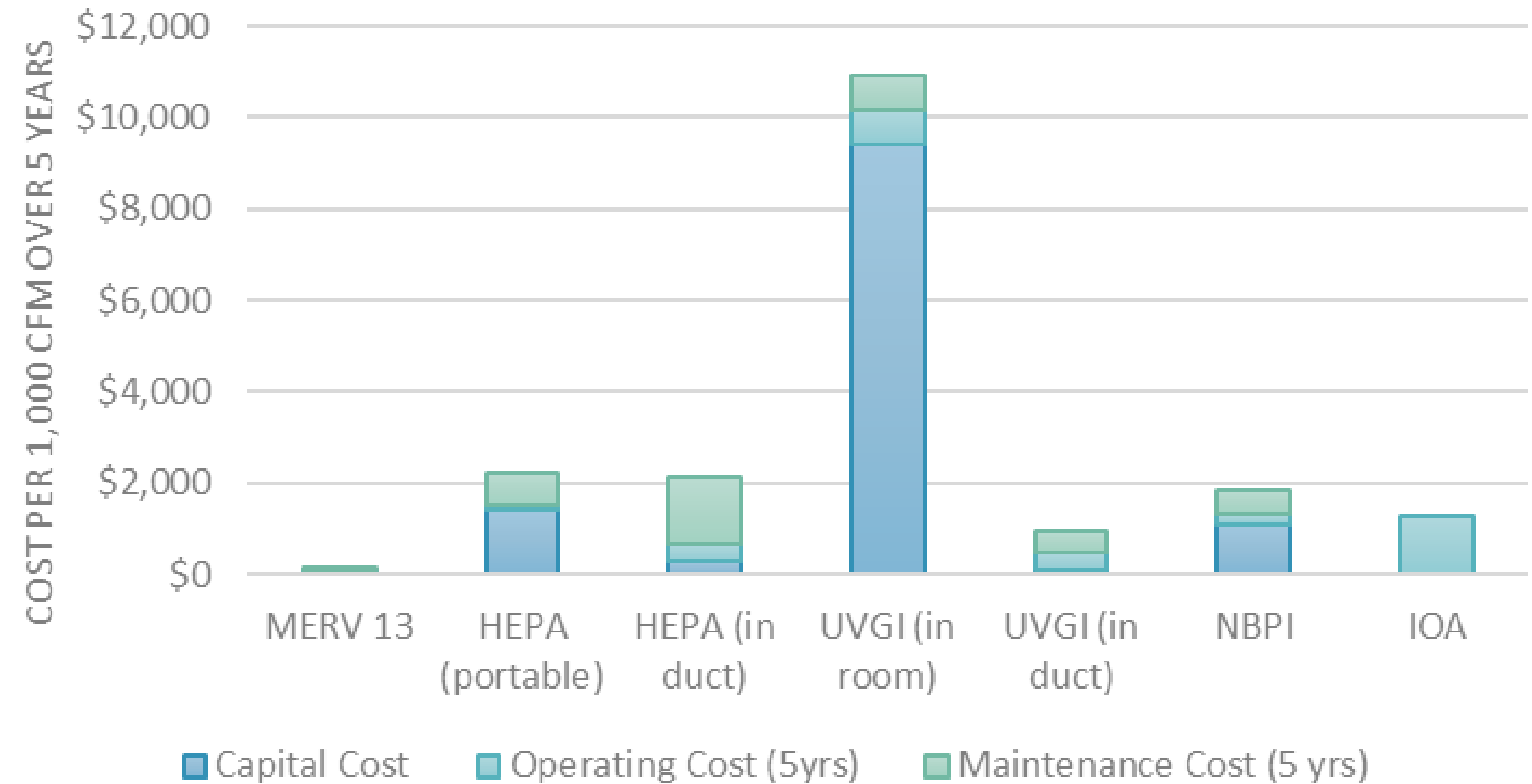


Biggest
Capital
Costs:
UVGI (in-
room)
~ \$9,394

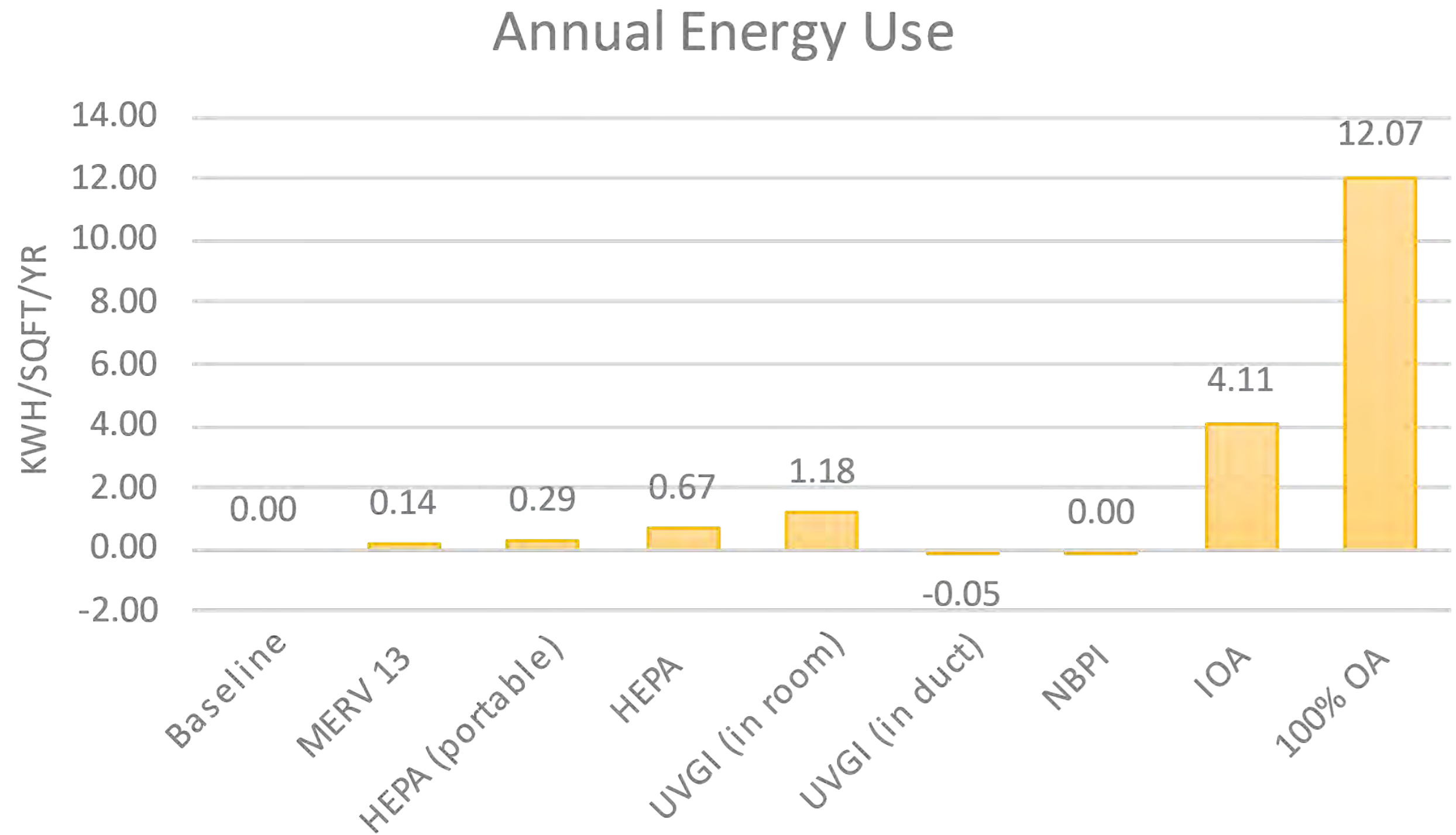
Biggest Annual
Operating Costs:
Increasing
Outdoor Air
~ \$260 /1000cfm

Biggest Annual
Maintenance
Costs:
In-Duct HEPA
~ \$300 /1000cfm

Cost Breakdown



In-Duct UVGI
has the
potential for
**energy
savings!**



PORTABLE HEPA FILTER

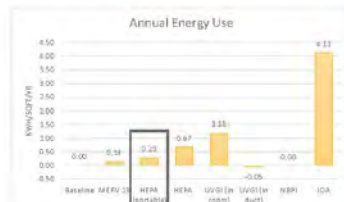
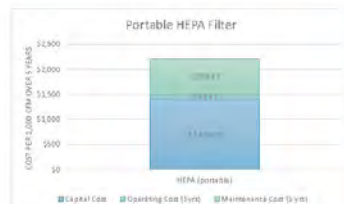
DESIGN GUIDELINES

- Change filter regularly according to manufacturer's guidelines.
- Best placed in high traffic areas
- Choose a portable air cleaner with an adequate CADR (clean air delivery rate) for the space size.
- CADR only refers to particles. Some systems come with an activated carbon filter, which can be effective at removing gases and VOC's, although there is no widely used performance rating systems.

⚡ + 0.29 kWh/sqft
\$ + \$18.28 /1000cfm
👍 99.7% effective



Portable HEPA filters are the simplest way to maximize filtration without modifying the existing building ventilation system. However, due to the high costs associated (both capital and operating costs), in-room filters are best suited for areas where contamination risk is higher or when outdoor air does not meet air quality standards (i.e. wildfire smoke).



HEPA	<ul style="list-style-type: none">• Portable, "plug and play" option• More effective at filtering sub-micron and nanoparticles• Units can be moved throughout a space in order to optimize effectiveness	<ul style="list-style-type: none">• Takes up floor space and outlets• Noisy at high speeds• Additional maintenance to care for units and change out filters when needed
MERV	<ul style="list-style-type: none">• Single-point intervention. No extra space needed• Minimal change to maintenance requirements• Easy to install into existing HVAC systems	<ul style="list-style-type: none">• Less effective at filtering sub-micron and nanoparticles• Effectiveness is limited by air flow since particles and aerosols still travel within the space before being pulled into the return air vent

1. ASHRAE "Filtration and Air Cleaning Summary" ASHRAE, 25 May 2021, COVID-19 Response Accessed 10 Sept 2021.
2. ASHRAE "ASHRAE Guidelines Task Force" Core Recommendations for Reducing Airborne Infection Aerosol Exposure, 2021, Accessed 2021.
3. Wang, Xiaohong, et al. "Energy Consumption of Using HEPA and Portable Air Cleaners in Hospitals: A Monitoring Study in South China." *Energy and Buildings*, vol. 218, 2021, p. 107772, <https://doi.org/10.1016/j.enbuild.2021.107772>.
4. Fisk, W. J., et al. "Performance and Costs of Portable Air Cleaners Reducing Indoor Air Quality." *Indoor Air*, vol. 12, no. 4, 2002, pp. 259-264, [https://doi.org/10.1016/S1161-0316\(02\)00055-5](https://doi.org/10.1016/S1161-0316(02)00055-5).

UPPER ROOM DISINFECTION UVGI



In-room UVGI is a powerful method of disinfection that requires significant capital and operational costs. These systems are well suited for health care facilities and spaces with higher disinfection requirements. In other settings, an in-room HEPA filter is a more suitable alternative.

Ultraviolet germicidal irradiation, or UVGI, uses short-wave UV energy to inactivate viral, bacterial, and fungal organisms so they are unable to replicate and cause disease or illness.



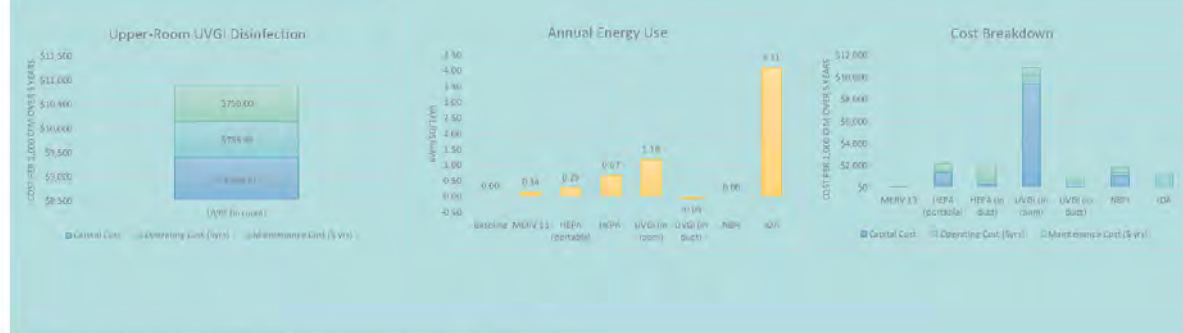
⚡ + 1.18 kWh/sqft

\$ + \$151.17 /1,000cfm

👍 Properly Installed and operated lamps are 99% effective.

DESIGN GUIDELINES

- Approximately one 17W lamp per every 200 ft²
- Ideal UV-C intensity for disinfection is >10 uW/cm²
- Mount fixtures no less than 7 ft from the floor in a room with a minimum ceiling height of 8 ft
- Replace lamps every 1-2 years, or according to manufacturers recommendations.
- Well-mixed spaces increase the amount of air that comes into contact with the UV beam.
- Effectiveness of UVGI depends highly proper installation and operation.



1. ASHRAE "ASHRAE Guidelines Task Force" Core Recommendations for Reducing Airborne Infection Aerosol Exposure, 2021, Accessed 2021.
2. ASHRAE "Filtration and Air Cleaning Summary" ASHRAE, 25 May 2021, COVID-19 Response Accessed 10 Sept 2021.
3. "Fundamentals of UVGI" ASHRAE, 2 May 2021, COVID-19 Response Accessed 10 Sept 2021.
4. Chou, W. J., et al. "Energy Consumption of Using HEPA and Portable Air Cleaners in Hospitals: A Monitoring Study in South China." *Energy and Buildings*, vol. 218, 2021, p. 107772, <https://doi.org/10.1016/j.enbuild.2021.107772>.
5. "Upper-Room Ultraviolet Germicidal Irradiation" CDC, 2021, Accessed 2021.

MERV FILTER

Minimum Efficiency Reporting Value



Upgrading to a higher rated MERV filter can be a simple way to improve indoor air quality, assuming the existing HVAC can accommodate the increased pressure drop. To ensure maximum efficiency, filters must be sized correctly and sealed in place. It is also essential that filters be replaced regularly according to manufacturer's guidelines.

⚡ + 0.14 kWh/sqft

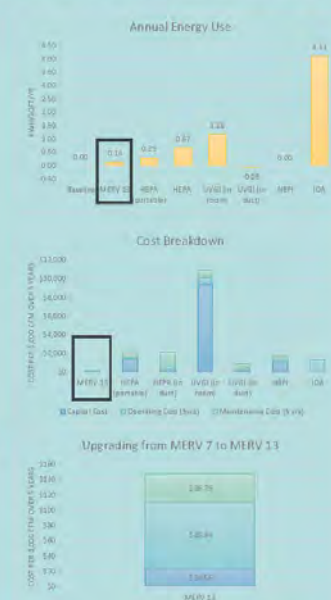
\$ + \$17.19 /1,000cfm

👍 Removes 85-90% of particles between 3-10 um¹

DESIGN GUIDELINES

- ASHRAE recommends MERV-13 or higher for commercial buildings².
- When upgrading to a higher MERV rating, look for a filter with a similar pressure drop to your current filter, or makes sure your HVAC system can accommodate the upgrade.
- To ensure filter efficiency, be sure your filter fits precisely in your system or is sealed in place to prevent leakage.
- Replace your filter regularly according to the manufacturer's recommendations.
- In practice, viruses are almost always embedded in particles that are much bigger than the virus itself. ASHRAE reports the virus mostly occurring in particles between 1 um to 5 um¹.
- Particle filters don't remove VOC's or ozone

	EFFICIENCY	PRESSURE DROP (IN. H ₂ O)
MERV 5	32%	0.17
MERV 12	78%	0.15
MERV 13	89%	0.18
MERV 14	97%	0.24
HEPA	99.9%	0.5



1. Zhang, Xue, et al. "Study of Viral Filtration Performance of Residential HEPA Filters." *ASHRAE Journal*, Aug. 2020.
2. Alvar, Mark, and Jeffrey A. Siegel. "VOC and Energy Implications of High Efficiency Filters in Residential Buildings: A Review." *ASHRAE Transactions*, vol. 118, no. 2, 2008, pp. 289-301.
3. Chen, Xue, and Jeffrey A. Siegel. "VOC and Energy Implications of High Efficiency Filters in Residential Buildings: A Review." *ASHRAE Transactions*, vol. 118, no. 2, 2008, pp. 289-301.
4. ASHRAE Handbook HVAC Systems and Equipment, 2008, pp. 24.2-24.3.
5. Alvar, Mark, and Jeffrey A. Siegel. "VOC and Energy Implications of High Efficiency Filters in Residential Buildings: A Review." *ASHRAE Transactions*, vol. 118, no. 2, 2008, pp. 289-301.
6. ASHRAE "Filtration and Air Cleaning Summary" ASHRAE, 25 May 2021, COVID-19 Response Accessed 10 Sept 2021.

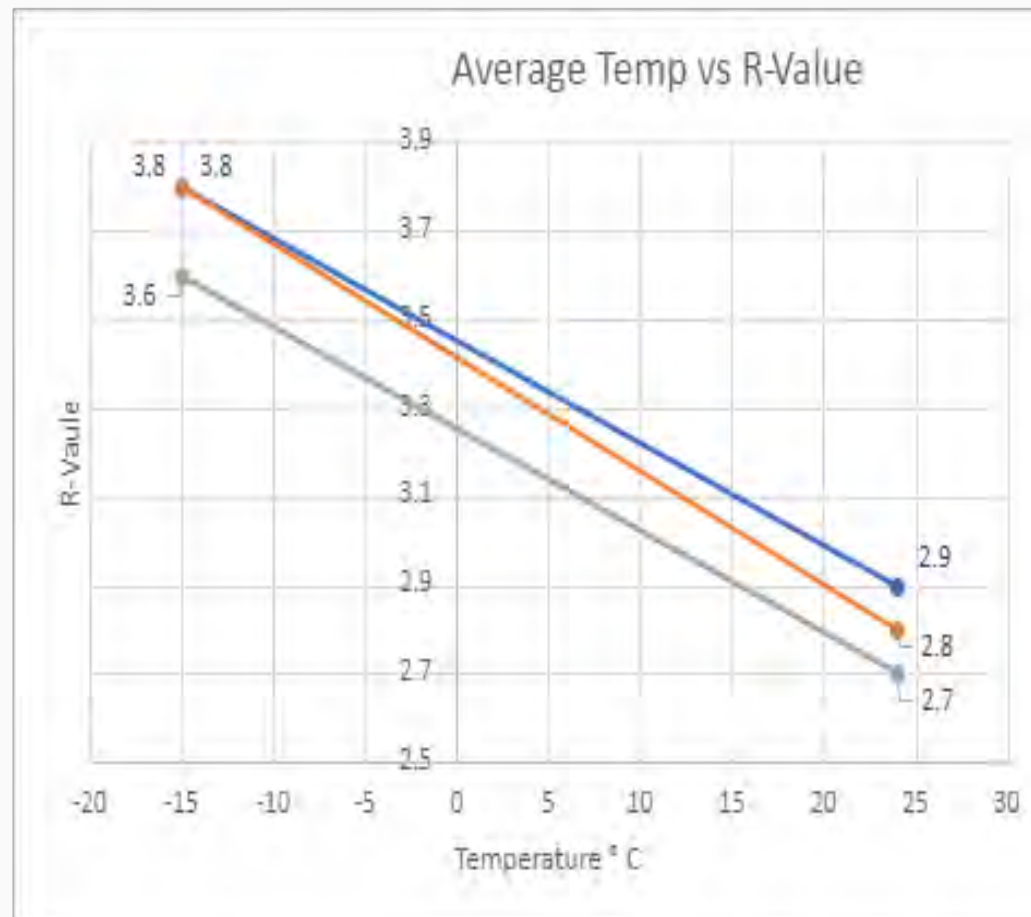
The background is a detailed architectural wireframe of a modern building interior. It features a multi-level structure with a prominent staircase on the right side, leading up to a higher level. The walls and ceiling are composed of a grid of lines, suggesting a glass or metal frame. A dark horizontal band across the middle of the image contains the text.

HEMPITECTURE

BIO-BASED BUILDING MATERIALS

Fire and Thermal Resistance Testing

1. Outfitted labs in Boise and Moscow for testing
2. Tested samples and benchmarked performance
3. Identified formulation that achieves “Class A” fire rating for products



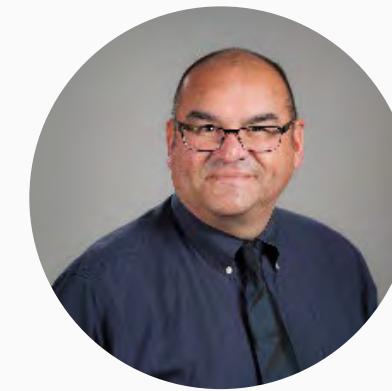
An Integrated Team



Damon Woods, Ph.D.
Research Assistant Professor
Interim Director - IDL



Matthew Mead
Hempitecture
CEO and Founder



Armando McDonald, Ph.D.
Professor of Renewable Materials
Chemistry



Lili Cai, Ph.D.
Assistant Professor of
Renewable Materials



Isabelle Boicourt
Senior in Civil Engineering



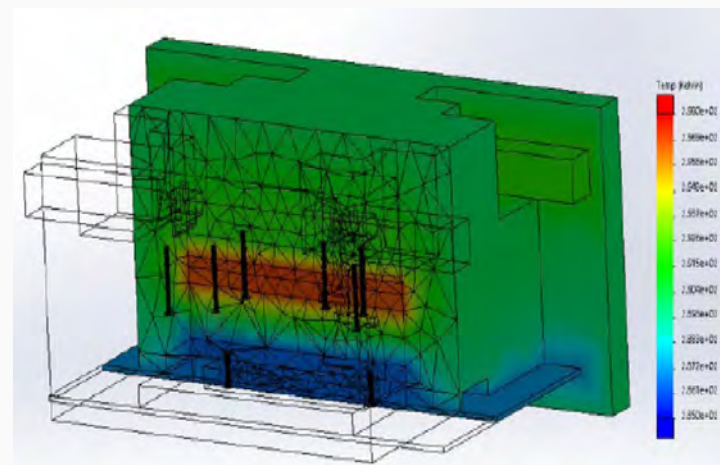
Tyler Schram
M.Arch Student



Abdulbaset Alayat, Ph.D.
Postdoctoral Researcher - CNR

Project Impacts:

- Product testing and development.
- Manufacturing plant opening this month.
- Job creation in Idaho (manufacturing, farming, transportation, installation, etc.)

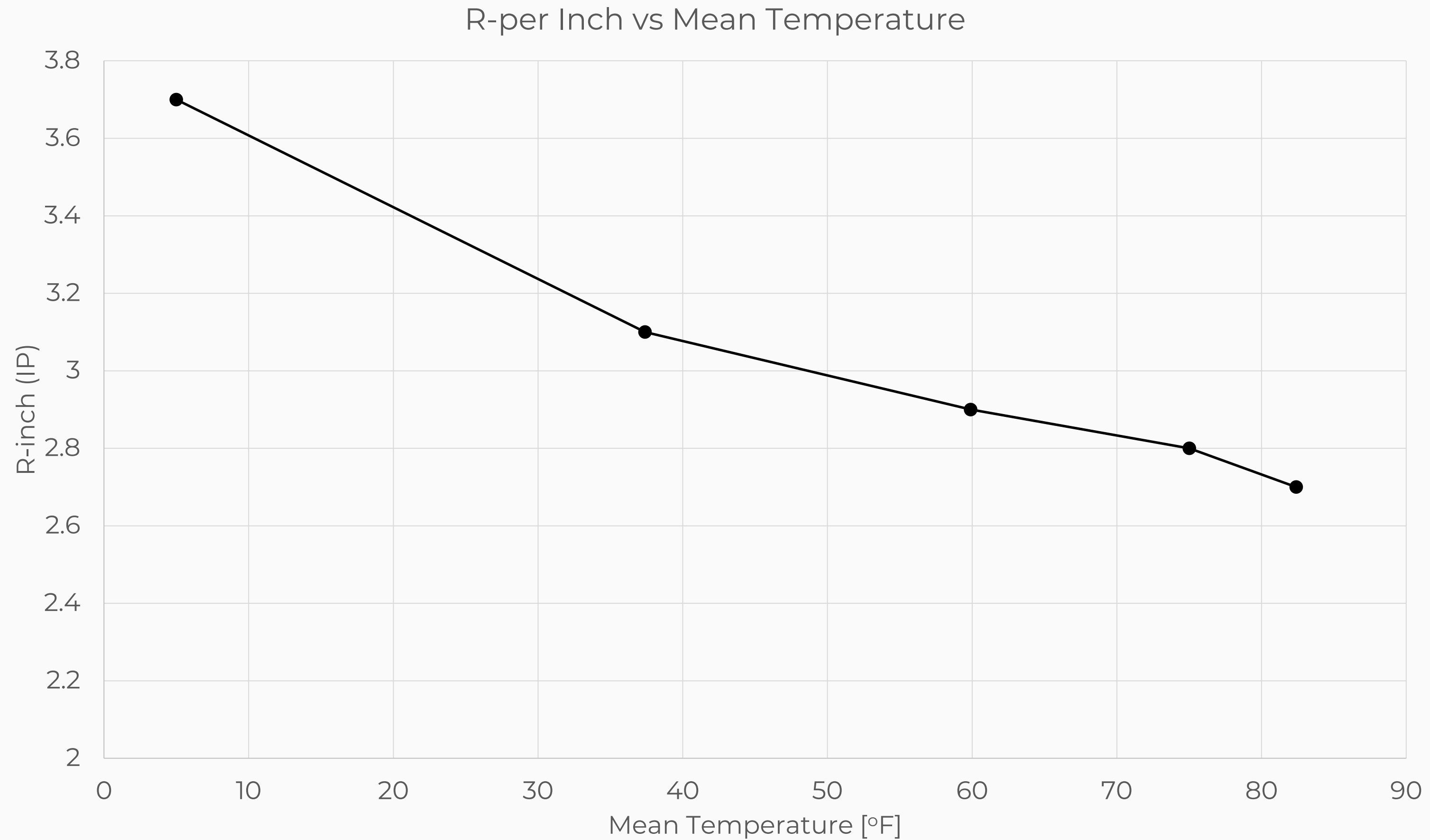


Commissioning the Manufacturing Plant:

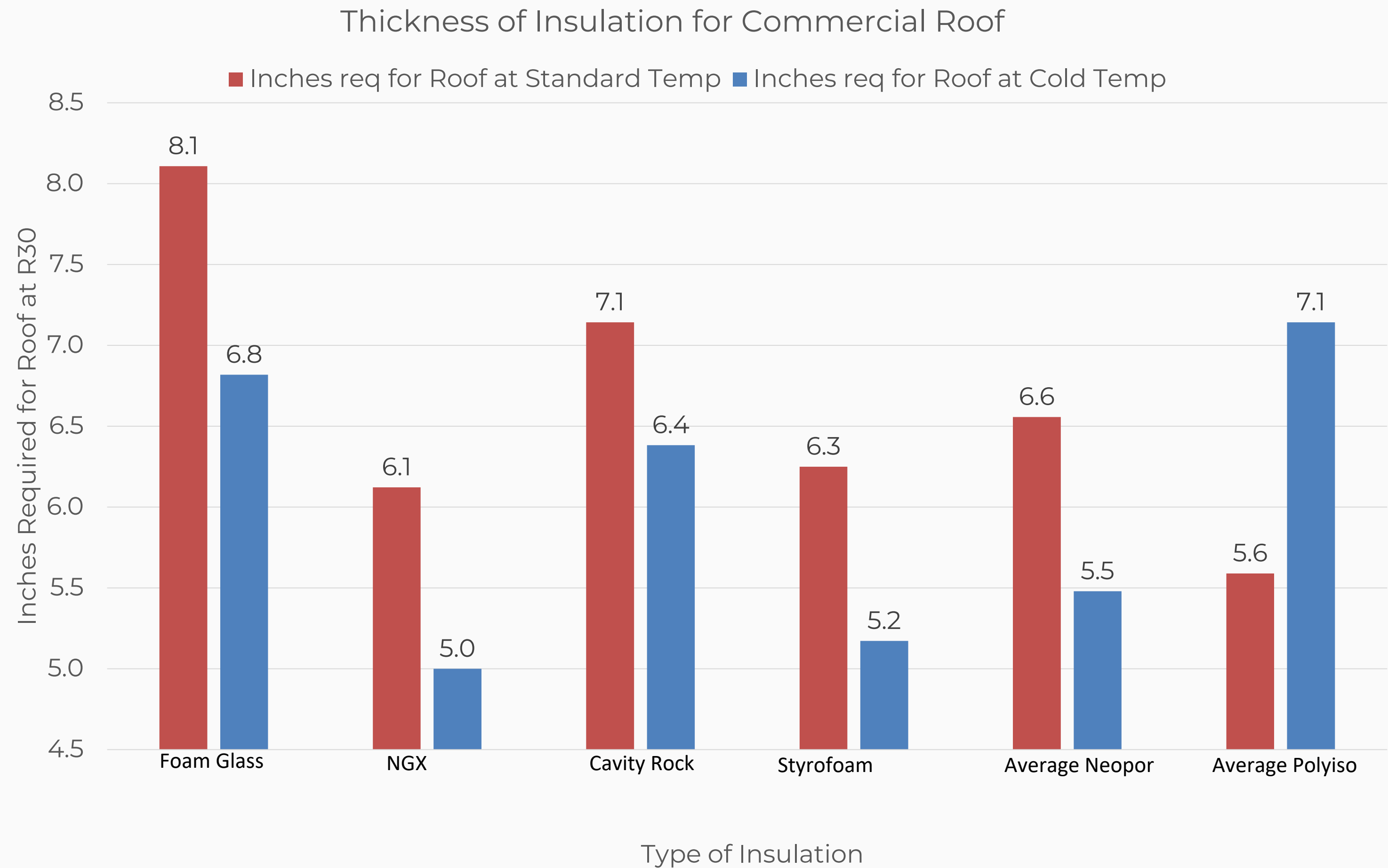
- Optimizing fire retardant application
- Considering additives and new product configurations
- Achieve higher R-value than current imports



Project Findings: Performance is temperature dependent



Project Findings: Performance is temperature dependent

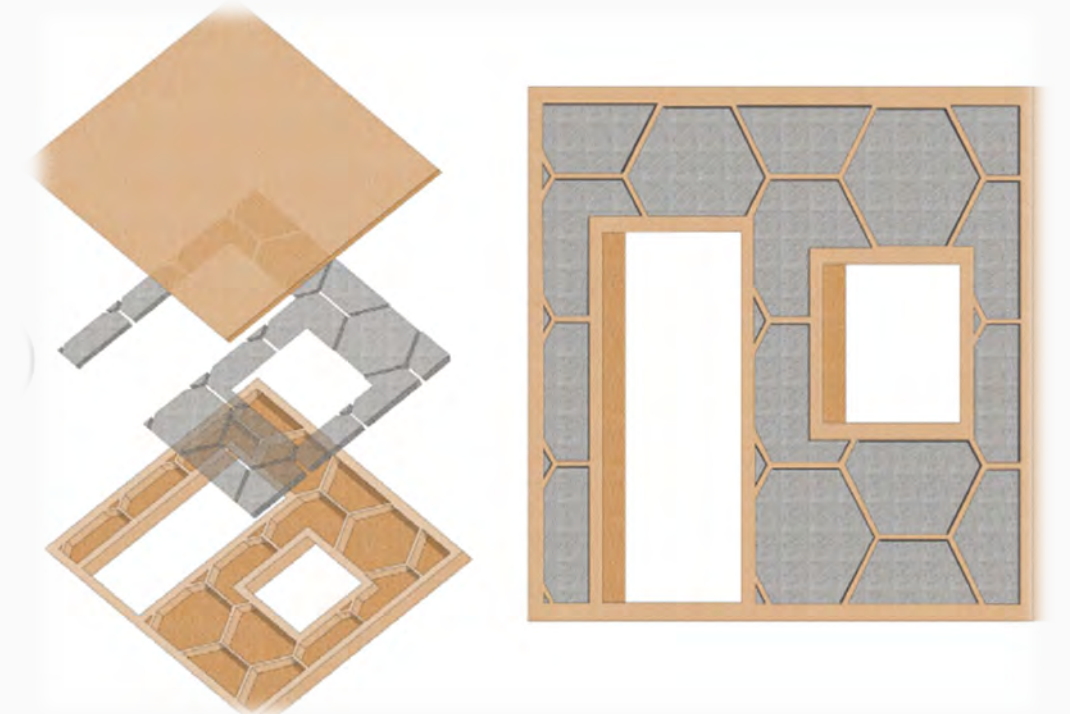
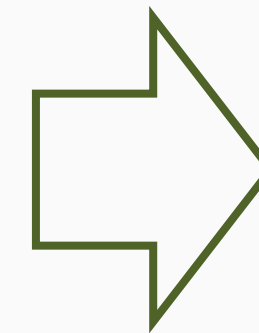
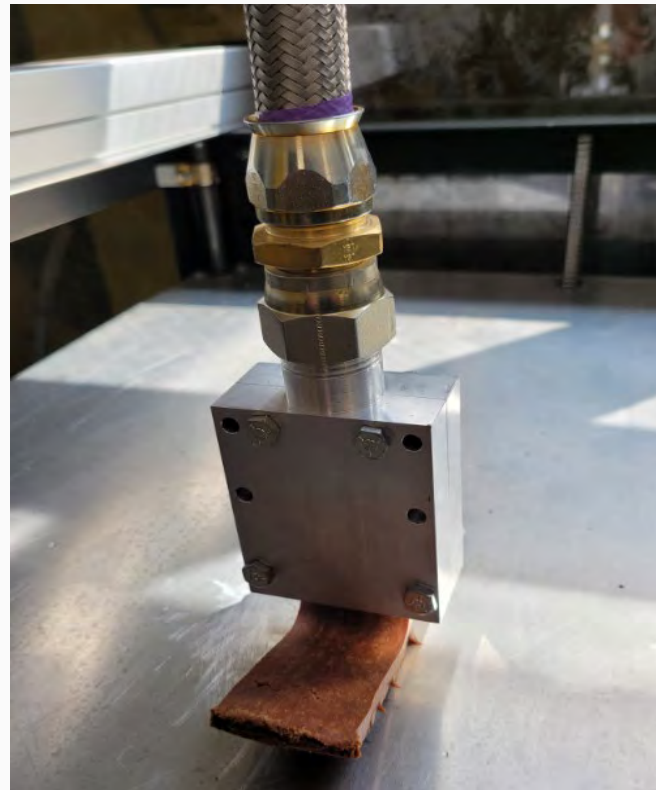


An architectural sketch of a modern, multi-story building with large windows and a grid floor. The building is rendered in a sketchy, line-art style with brown lines on a white background. The foreground shows a grid pattern representing a floor or a platform. A dark horizontal band across the middle of the image contains the text.

PRINTIMBER

3D PRINTING WITH WOOD PULP

Using Bio-based Materials for the Future



Other Lab Research Areas

1. Connected Communities
2. AI thermostats for DCV and lighting controls
3. Rural Energy Audit Program
4. Energy Code Training
5. Residential IAQ (wildfire smoke + Covid)





University of Idaho
College of Art and Architecture

ANY QUESTIONS?

www.idlboise.com