

HVAC Building Operations and IAQ at Pandemic's "End"

Unraveling pandemic, policy, and other
guidelines
to understand HVAC best practices and
efficient building operations

Karen Janowitz, Program Manager – Washington State University Energy Program

Rebecca Sheppard, Sr. Project Manager – NEEC / Smart Buildings Center



WASHINGTON STATE UNIVERSITY
Energy Program

Objectives

- Share information on how others navigate the changes in HVAC operations due the the pandemic
- Learn about different Indoor Air Quality guidelines and how they intersect with Energy Efficiency goals



Envisioning a World with Net-Zero Carbon Emissions

NEEC's mission is to eliminate carbon emissions from building energy use through market-based thought leadership, education, and advocacy.

www.neec.net/programs/

NEEC PROGRAMS



Smart Buildings Center

A multi-functional energy efficiency headquarters in Seattle, Washington. This facility is a place to meet, train and access our Tool Lending Library.



Tool Lending Library

Diagnostic tools for short term loan available to building owners, managers and energy service professionals in Washington and Oregon.



Building Operator Certification

A training program that offers facilities personnel skills and knowledge to transform workplaces to be more comfortable, energy-efficient and environmentally friendly.



2 Technical Assistance Helpdesks

The Clean Buildings Performance Standard Helpdesk
The K-12 Ventilation & Indoor Air Quality Helpdesk

WSU Energy Program

- Self-supporting department within Washington State University based in Olympia
- This presentation is part of the **Resource Conservation Management (RCM) Program**
- Other programs: community solar, least-conflict solar siting, Washington state energy codes (residential) support, green transportation education and outreach, community energy efficiency, workforce development

<https://www.energy.wsu.edu>





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Facility Energy Program Manager
King County Metro Transit



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Director of Maintenance and Operations
Mead School District



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Building Performance Specialist
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Energy Impacts of “Pandemic Mode” HVAC Operations

Nicole Laky, Facility Energy Program Manager

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King County Metro Transit

- 60+ million passenger boardings per year
- 115 Park & Rides and Transit Centers
- **12 Bus Bases & Support Facilities**



Bus Bases

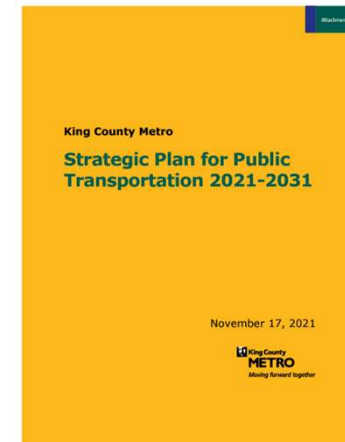
- Vehicle Maintenance
- Operations/Dispatch
- Fuel & Wash
- Bus Yard



Climate & Equity Goals

- Reduce building energy use (electricity + natural gas)*
 - 12.5% by 2025
 - 17.5% by 2030
- **Reduce fossil fuel use in existing systems***
 - 20% by 2030
 - 50% by 2040
 - 80% by 2050
- Inventory fossil fuel equipment and develop elimination plans
- No new fossil fuel systems installed

*Baseline 2014



COVID-19 Impacts to HVAC*

Space Type	Pre-pandemic	Height of Pandemic
Vehicle Maintenance	MERV 8 and/or 11 100% Outside Air (OA)	MERV 13 (where applicable) No change to OA
Operations/Dispatch	MERV 8 and/or 11 OA based on need	MERV 13 (where applicable) + Periodic “flushes” of OA
Fuel & Wash (partially outdoor)	Freeze protection only.	No change
Bus Yard (outdoor)	No HVAC	No change

* Varies by space and building. “Typical” operations shown here.

Filtration & Ventilation Impacts

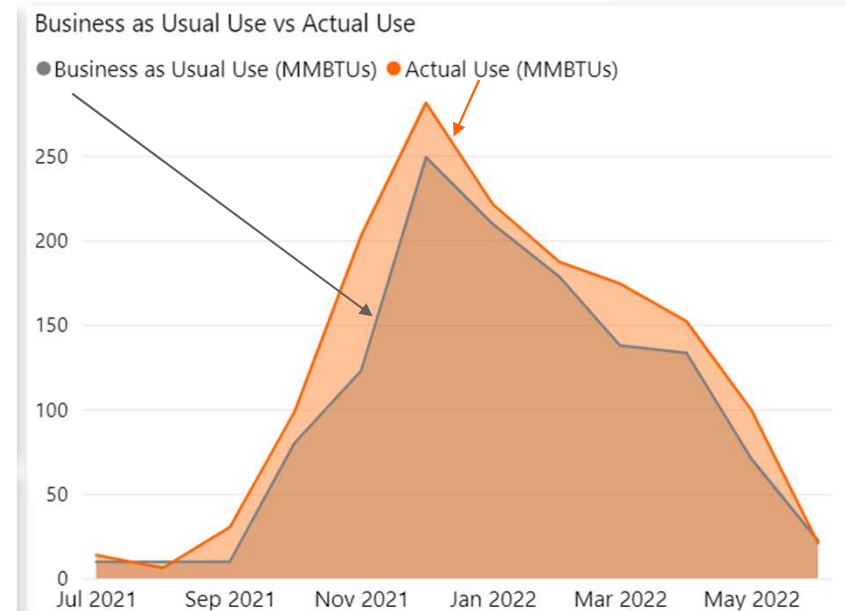
HVAC Operations	Pros	Cons	Energy Impact	Energy Goals/ Budget Alignment
Higher Air Filtration (e.g. MERV-13)	<ul style="list-style-type: none"> Improved indoor air quality Increased ability to filter wildfire smoke 	<ul style="list-style-type: none"> Increased maintenance costs for materials and labor 	< 1% increase	YES
Significantly increased ventilation rates (e.g. periodic flushing or 100% outside air)	<ul style="list-style-type: none"> HVAC operations far exceed code to potentially reduce exposure to airborne contagions Programming for HVAC systems already in place 	<ul style="list-style-type: none"> Extent of benefits unclear when occupants are unmasked and in close proximity Inability to meet heating and cooling set points in many areas Increased smoke infiltration into bldgs. during wildfire events Increased wear and tear on equipment Substantially more difficult to meet GHG reduction goals 	5% to 40% increase	NO

Energy Impacts of Ventilation Changes

Case Study: Atlantic-Central Operations Bldg

- HVAC system in continuous operation throughout the pandemic. No change in occupancy.
- Periodic “flushing” created need for additional energy to heat more outside air
- **~ 20% increase in natural gas use = INCREASE in greenhouse gas pollution**
- Moves us farther away from achieving climate and equity goals

Natural Gas	
-255	-20.7 %
Total Avoided Use	Savings as % of Baseline
0	-255
Electricity Avoided Use	Natural Gas Avoided Use

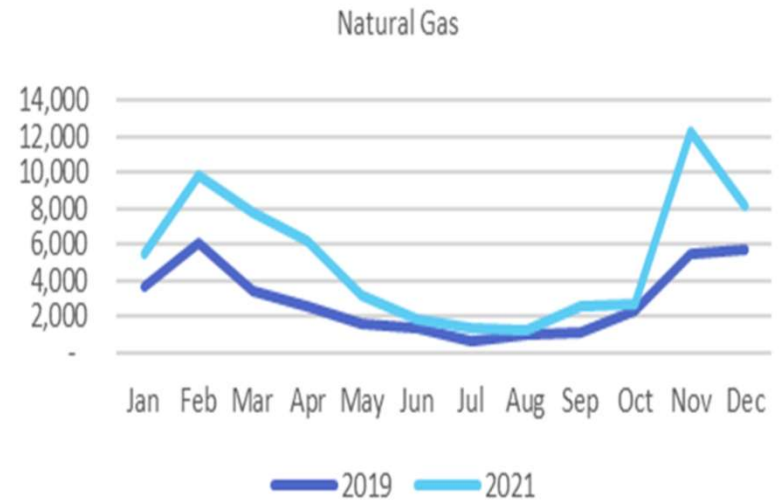


Energy Impacts of Ventilation Changes

Case Study: King County High Rise Office Bldg

- HVAC system in continuous operation throughout the pandemic. Very low occupancy.
- 100% outside air negated all savings realized from 2021 LED lighting project.
- **~ 70% increase in natural gas use**
- No longer eligible for Energy Star Certification

Chinook Building Natural Gas Use



Healthy Indoor Air for Staff

Washington State Dept. of Health has emphasized the ventilation and air filtration are not effective alone.

Masking + Distancing + Disinfection + Vaccination + Ventilation

None of these actions will eliminate risk completely. All have pros/cons that need to be weighed against potential benefits to occupants.

Per CDC, overall transmission reduction from increased ventilation is less likely to apply to people who are very close (e.g. face-to-face) to the infectious source

COVID-19 Impacts to HVAC*

Space Type	Pre-pandemic	Height of Pandemic	Pandemic-impacted world (today)
Vehicle Maintenance	MERV 8 and/or 11 100% Outside Air (OA)	MERV 13 (where applicable) No change to OA	MERV 13 (where applicable) No change to OA
Operations/Dispatch	MERV 8 and/or 11 OA based on need	MERV 13 (where applicable) + Periodic “flushes” of OA	MERV 13 (where applicable) OA based on need + CO ₂ monitoring (where feasible) + Plan for high-risk & high-occ areas
Fuel & Wash (partially outdoor)	Freeze protection only.	No change	No change
Bus Yard (outdoor)	No HVAC	No change	No change

* Varies by space and building. “Typical” operations shown here.

Lessons Learned

- Focus on ensuring that existing equipment is working.
- Go deeper than the headline. One-size does not fit all.
- Just because it's outside air does not make it "clean" or "healthy" air
- HVAC systems are dynamic, and operations change continuously

Returning to “Normal”
Featuring
Evergreen Elementary School



By
Travis Bown

June 7th, 2023

Today's Agenda

Introduction – Who Am I?

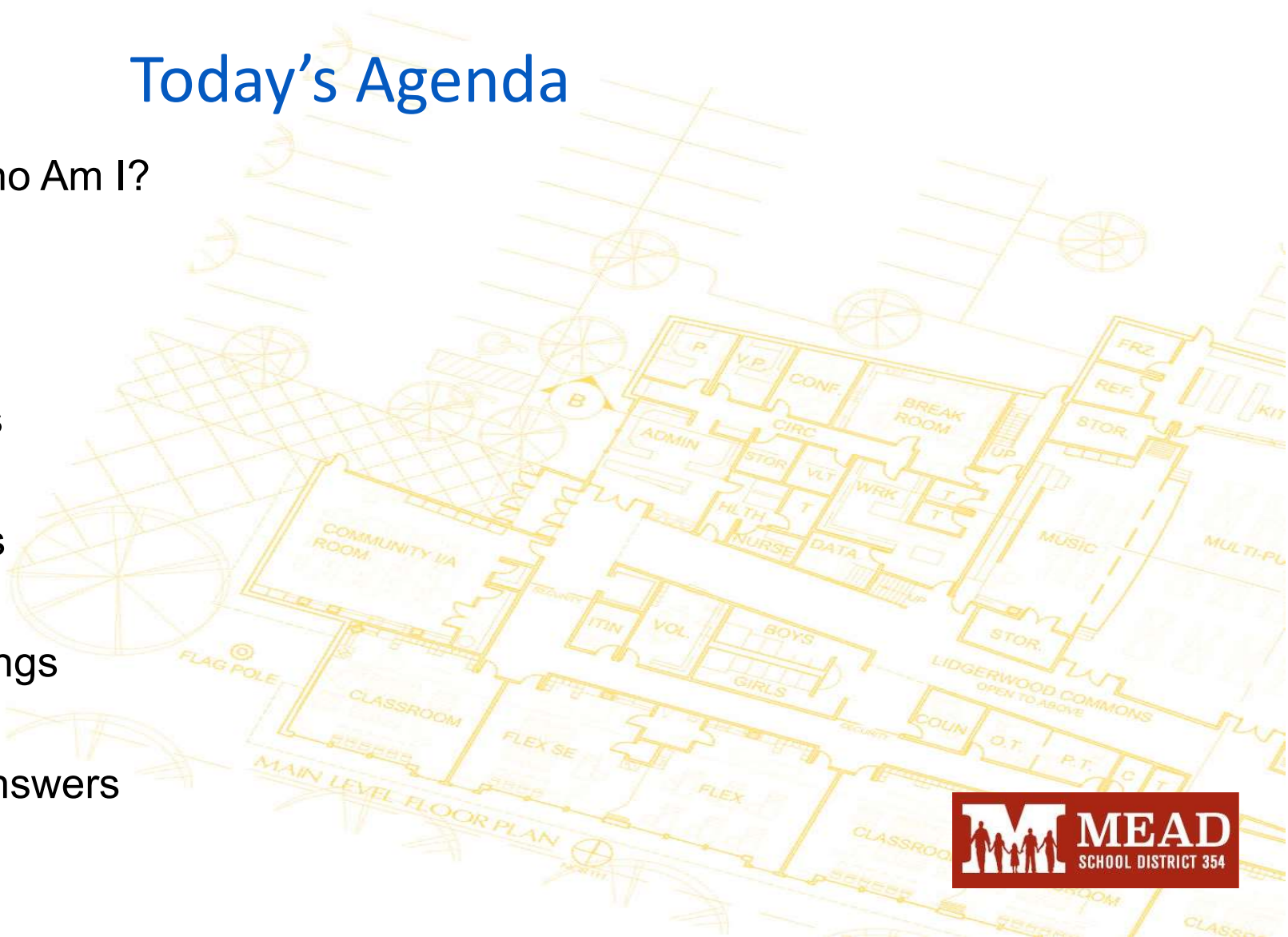
Why Evergreen?

Identifying Issues

Explore Solutions

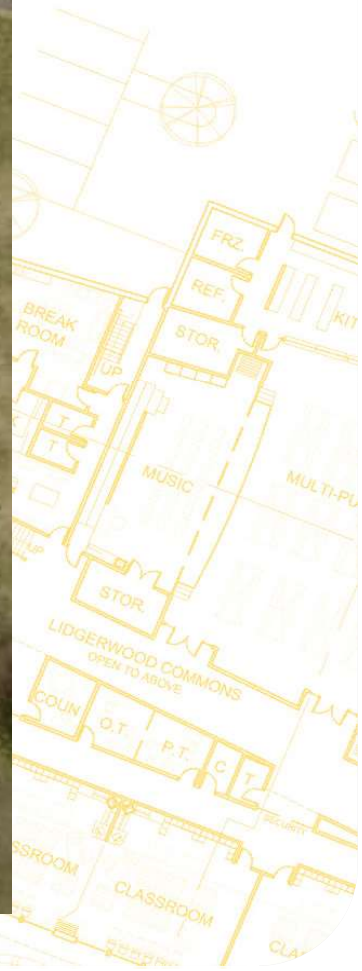
MERV Filter Ratings

Questions and Answers





 **MEAD**
SCHOOL DISTRICT



Evergreen Elementary 53,536 SF

- Originally Built in 1961. 35,366 sq/ft
- Modernized/Addition in 1991 (7,996 sq/ft)
- Addition in 2001 (10,204 sq/ft)
- New Roof in 2016
- New Boilers, Pumps, Variable Frequency Drives & Controls in 2022



Why Evergreen?

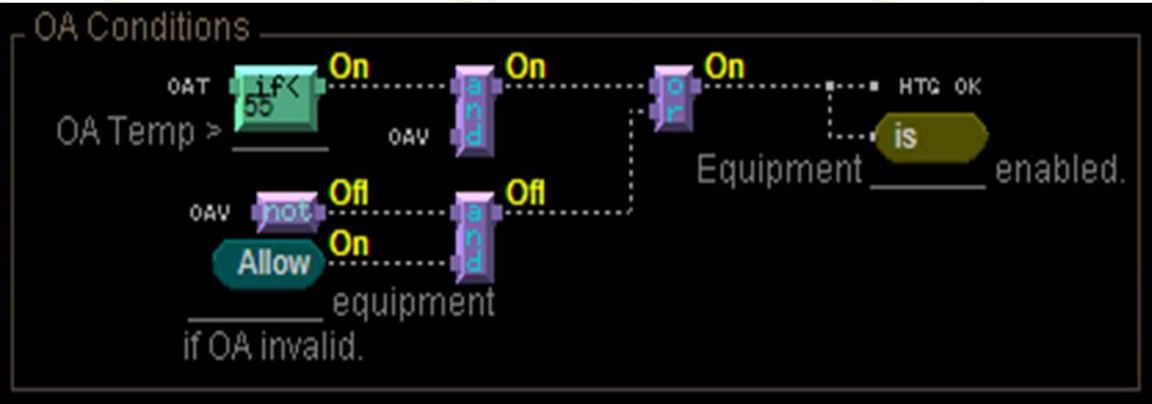
- 71.3 EUI Measured July 1, 2020 – June 30, 2021.
- Mechanical Upgrade Began June of '22.
- Control Upgrade Began Oct of '22.
- New Building Automation System (BAS) Strategies Implemented Late January of '23.

Question Your BAS Strategies.

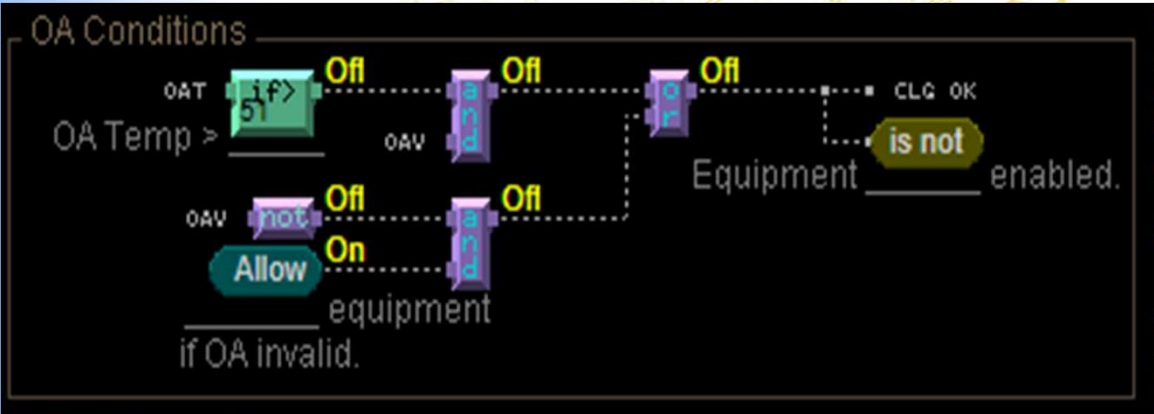
- Assess Run Time vs. Occupied Time?
- How Much Start/Stop Time Optimization is Needed?
- Night Setback vs Recover Time?
- Modify Demand Ventilation Set points?
- Scrub your Automation System!

Conflicting Logic

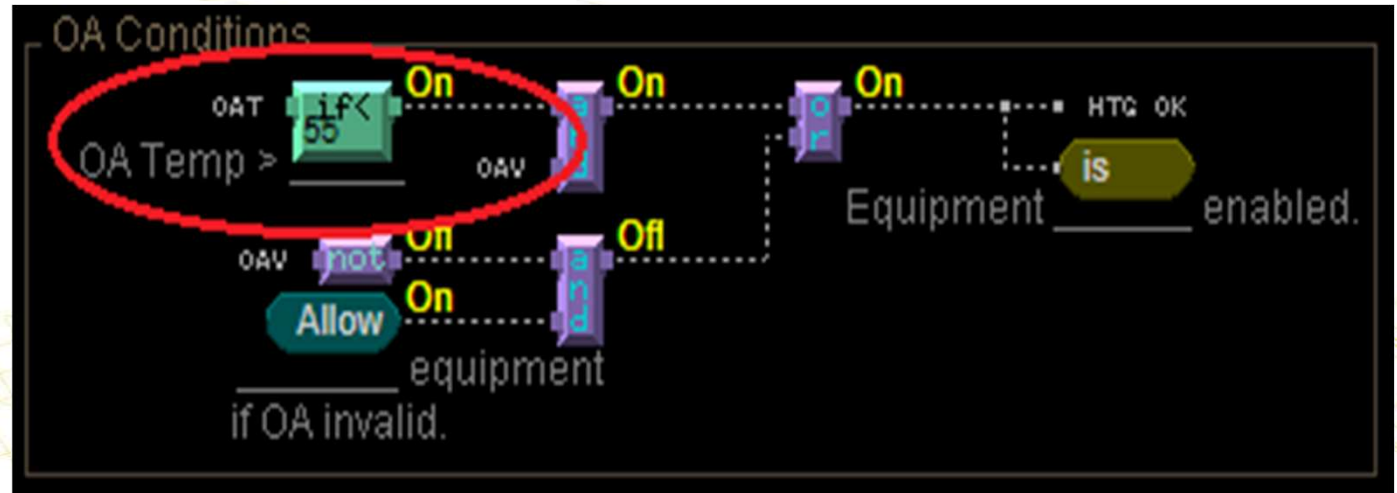
Boiler



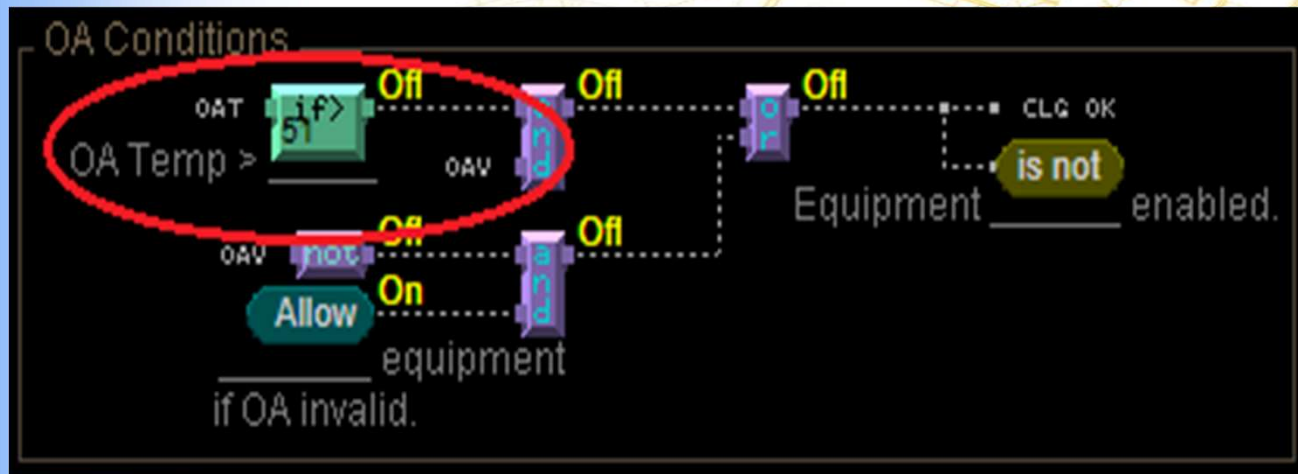
Chiller



Boiler



Chiller



Result Recap

- EUI W/COVID Strategies pre HVAC/BAS upgrade = **71.3**
- EUI W/COVID strategies post HVAC/BAS upgrade = **66.4**
- EUI gains in just 3 Months with new strategies = **57.6**
- **-13.3% Lower EUI**

MERV FILTERS

- The MERV 8 Debate VS 11 & 13,
Plus Our Experiment with Air Quality
Index & PM2.5
- Shelter In Place Switches and Indoor
Air Quality VS. PM2.5?

Thank you!



Clean Buildings Performance Standard and COVID Mitigation

Presenter

LUKE HOWARD

6/07/2023



Washington State
Department of
Commerce

We strengthen communities



HOUSING AND HOMELESSNESS



INFRASTRUCTURE AND BROADBAND



SMALL BUSINESS ASSISTANCE



ENERGY



PLANNING AND TECH ASSISTANCE



COMMUNITY SERVICES AND FACILITIES



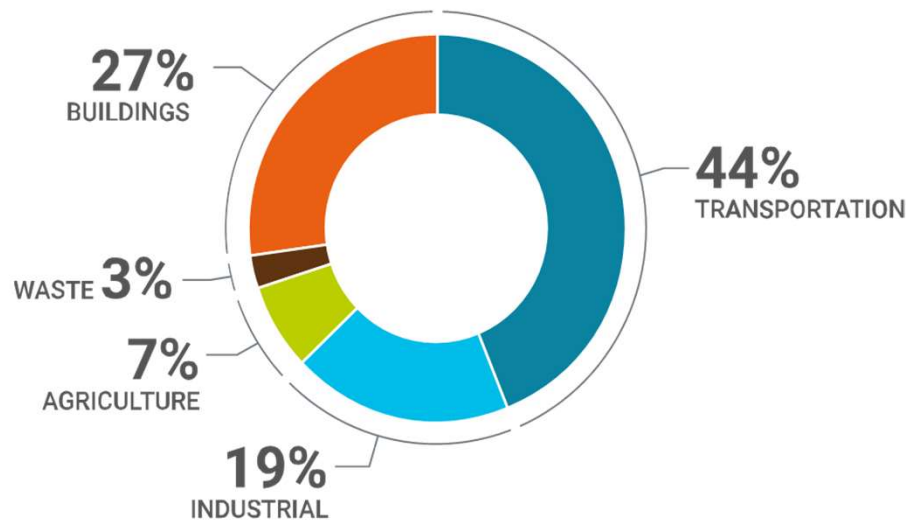
CRIME VICTIMS AND PUBLIC SAFETY



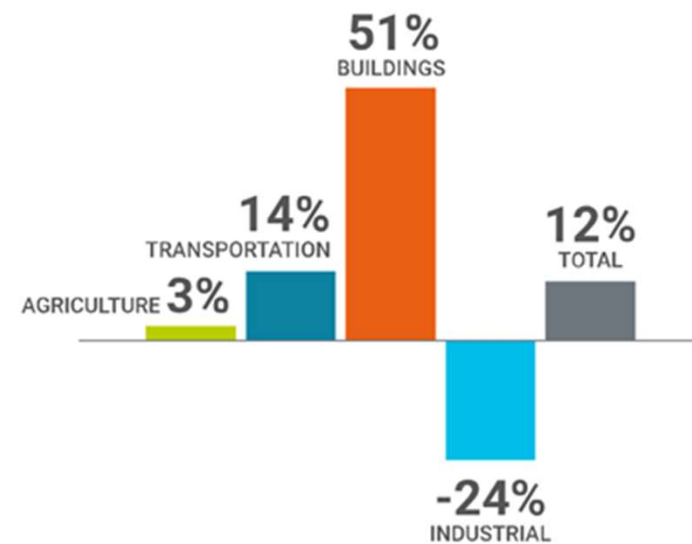
ECONOMIC DEVELOPMENT

Reducing emissions from existing buildings

Overall emissions in Washington

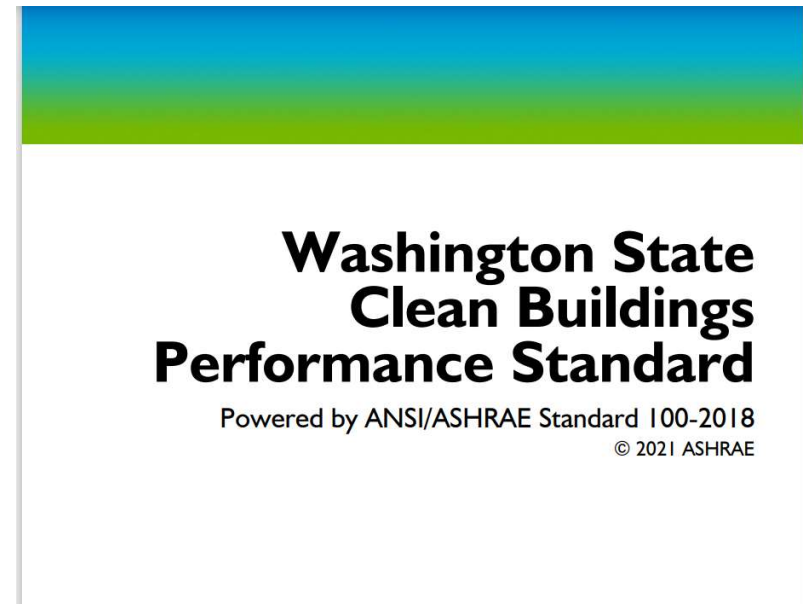


Emissions change by sector, 1990-2015



Clean Buildings Performance Standard

- Based on ASHRAE Standard 100-2018
 - Energy Efficiency in Existing Commercial Buildings
- WAC 194-50 – Rules for compliance and administrative requirements.
 - Amendment to Standard 100
- Integrated Standard available through the Clean Buildings website



Visit the Clean Buildings webpages for more information and resources at www.commerce.wa.gov/buildings or email buildings@commerce.wa.gov

Tier 1 requirements

- ✓ Benchmarking
- ✓ Implementation of an Operations and Maintenance program and Energy Management Plan
- ✓ Compliance with an energy performance metric
 - Energy use intensity target met
 - Or
 - Energy Audit and implementation of cost effective energy efficiency measures

covered building, tier 1:

>220,000 sf	
Comply by:	June 1, 2026
90,001-220,000 sf	
Comply by:	June 1, 2027
50,001-90,000 sf	
Comply by:	June 1, 2028

Tier 2 requirements

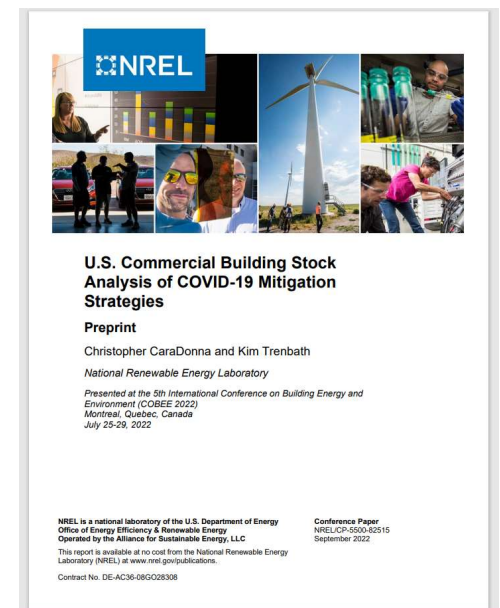
- ✓ Benchmarking
- ✓ Implementation of an Operations & Maintenance program and Energy Management Plan
- ~~✓ Compliance with an energy performance metric~~
 - ~~○ Energy use intensity target met, or~~
 - ~~○ Energy Audit and implementation of cost effective energy efficiency measures~~

NREL Modeled Effects of COVID Mitigation Strategies

ComStock model of several different commercial building types evaluated effects of COVID mitigation strategies

- MERV 13 filter upgrade
- Demand Control Ventilation Removal
- HVAC flushing
 - 2 hour pre and 2 hour post occupancy at 3 ACH
- 100% outside air
 - Baseline of 15% - 30% outside air

[U.S. Commercial Building Stock Analysis of COVID-19 Mitigation Strategies: Preprint \(nrel.gov\)](#)



Increase in Energy Consumption per Strategy

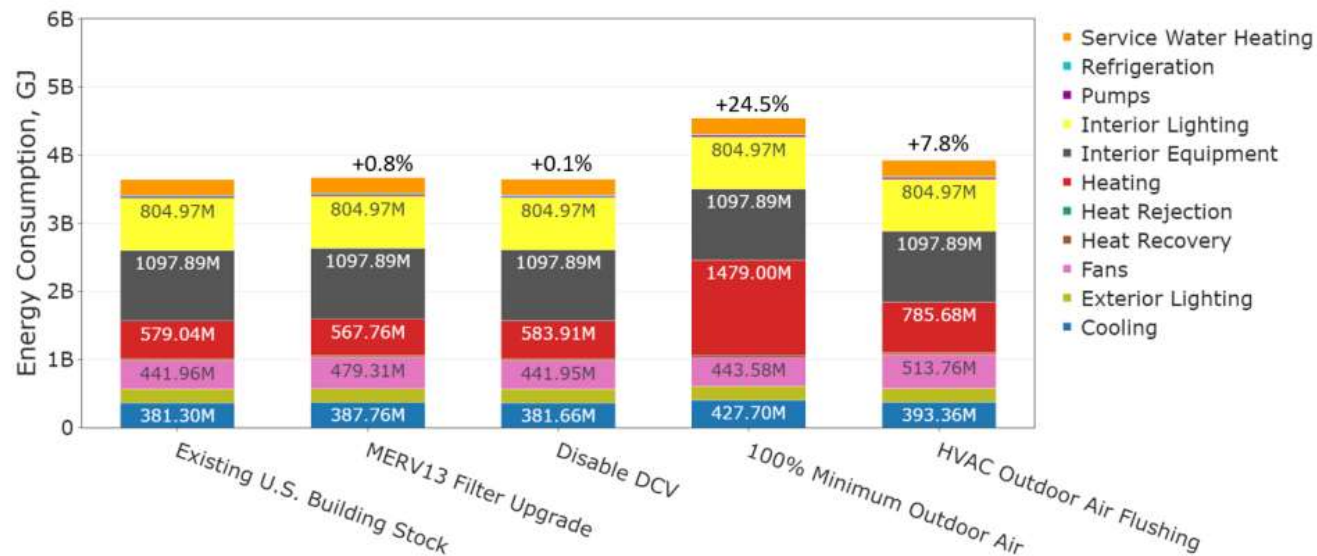


Figure 3. Annual energy consumption by major end use. Percentages shown are savings relative to the existing U.S. commercial building stock baseline.

Image: NREL

Increase in Energy Consumption per Climate Zone

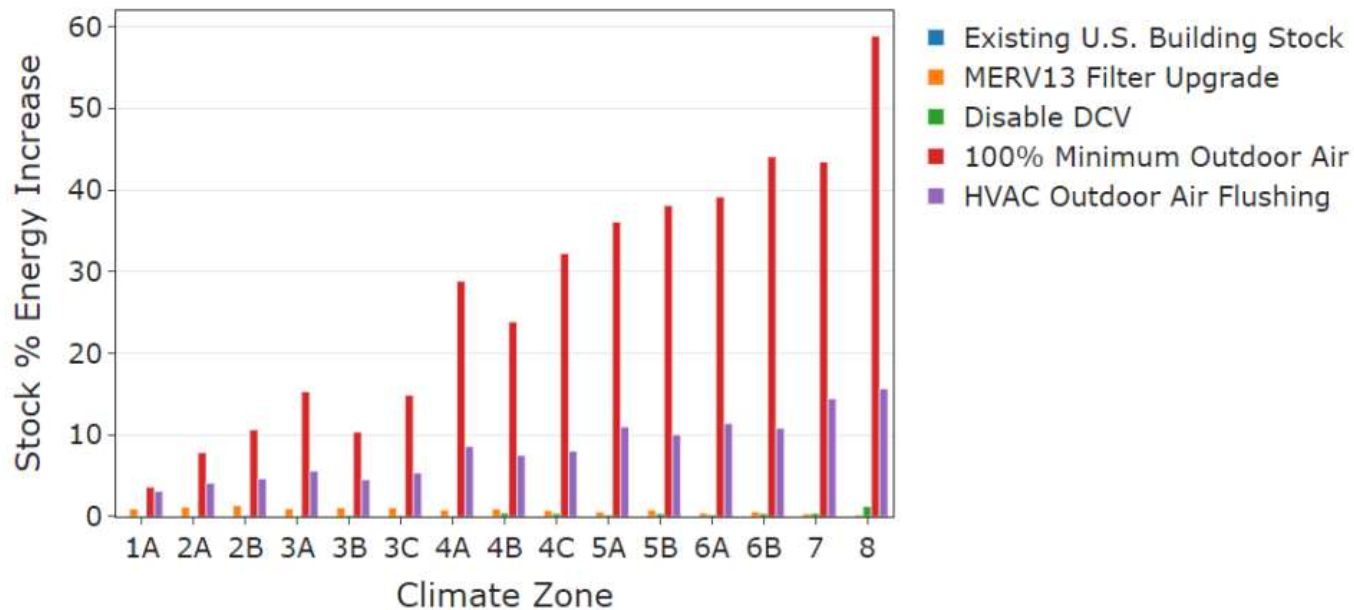


Figure 5. Percent stock savings for each COVID-19 mitigation strategy by climate zone.

Image: NREL

Increase in Energy Consumption by Building Type

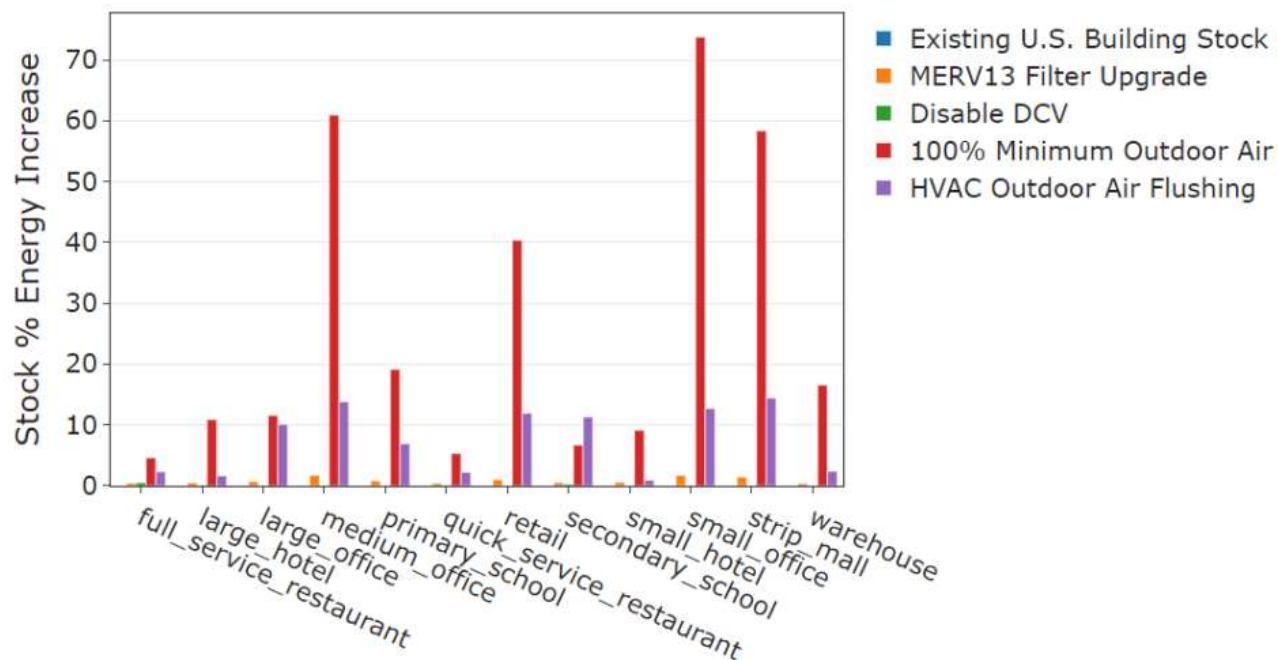


Figure 6. Percent stock savings for each COVID-19 mitigation strategy by building type.

Image: NREL

Commerce Response

Too early for Commerce to release guidance

- May allow for pre-COVID benchmarking energy data
 - Only benefits buildings meeting the target
- Possible introduction of a COVID mitigation normalization factor for highly impact buildings
 - Lots of variables
 - Building type
 - Operating hours
 - Mitigation strategy
 - Lack of real world data

Table 7-2a Building Activity Site Energy Targets (EUI1) (I-P Units)

No.	Building Activity Type ^{1,2}			Notes	Climate Zone	Climate Zone
	Portfolio Manager Types	Portfolio Manager Sub-Types	Sub-Types: Detailed		4C	5B
1	Banking/financial services	Bank Branch			69	71
2	Banking/financial services	Financial Office			69	71
3	Education	Adult Education			49	51
4	Education	College/University			102	102

Climate Zone 5B								
Gross Floor Area		100,000						
Building Activity Type	Gross Floor Area	Fractional Floor Area	Activity Energy Target (EUI)	Weekly Hours	Operating Shifts Normalization Factor	Space (EUI)	More recently built buildings Space (EUI)	
College/University	100,000	1.00	102	51 to 167	1.1	112	95.4	
		0.00						
		0.00						
		0.00						
		0.00						
		0.00						
		0.00						
		0.00						
		0.00						
Building Totals	100,000	1.00				112.2	95.4	

Clean Buildings Webpage

Clean Buildings

Clean buildings are essential to meeting our state energy goals. In 2019 the Clean Buildings bill was signed into law and later expanded in 2022. The objective is to lower costs and pollution from fossil fuel consumption in the state's existing covered buildings and multifamily buildings. The law also provides incentives to encourage building owners to make energy efficiency improvements earlier than required. Learn more about the [Clean Buildings Performance Standards](#).



Contact

Emily Saltberg
Buildings Unit Managing Director
Email: Buildings@Commerce.wa.gov
Phone: 206-725-9108

Need Help?

Submit any questions or support requests using the [Customer Support Form](#).

Subscribe

To sign up for updates or access your subscriber preferences, please enter your contact information below.

*Email Address

Submit



How to Comply

Building owners and their teams may not know where to start. Visit the [How to Comply](#) page to learn more about the steps to get started.



Frequently Asked Questions

Browse or search our [Frequently Asked Questions](#). If you can't find what you're looking for, send a question or comment to our staff by emailing Buildings@Commerce.wa.gov.



Clean Buildings Library

Get fact sheets, flowcharts, quick reference guides and other information about the [Clean Buildings Performance Standard](#).



Customer Support and Resources

Find resources from Commerce and other organizations that support compliance, including a directory of qualified persons and qualified energy auditors that may be able to assist you in compliance.



Clean Buildings Portal

The [Clean Buildings Portal](#) is a database of all Tier 1 buildings and provides building owners a secure system to manage their building's compliance with the [Clean Buildings Performance Standards](#) and submit applications to the [Early Adopter Incentive Program](#).

- [How to Comply](#)
- [Frequently Asked Questions](#)
- [Guidance Document Library](#)
- [Customer Support and Resources](#)
- [Early Adopter Incentive Program](#)
- [Clean Buildings Portal](#)
- [Customer Support Form](#)

Website: <https://www.commerce.wa.gov/buildings/>



Washington State
Department of
Commerce

www.commerce.wa.gov



Thank You!

www.commerce.wa.gov/buildings

buildings@commerce.wa.gov

360-725-3105



DOH RECOMMENDATIONS - IAQ

Nancy Bernard, MPH, REHS, CPSI
School Environmental Health and Safety
Indoor Air Quality
June 7, 2023

Washington State Department of Health
School Environmental Health & Safety Program

Our Mission

To protect and improve the
Environmental Health and Safety
condition of schools in Washington state.



School Environmental Health & Safety

- **Animals**
- **Control of Communicable & Zoonotic Diseases**
 - Disinfection and Green Cleaning
- **Hazardous Chemicals**
 - Arts, Science Labs, CTE
- **Indoor Air Quality**
 - Asthma, Mold, Ventilation, Filtration
- **Injury Prevention**
 - Athletics, Playgrounds, Fall Protection
- **Integrated Pest Management**
- **Lighting**
- **Noise**
- **Thermal Comfort**



DOH School Environmental Health & Safety Program

- Provide technical support & training
 - Local Health Jurisdictions (LHJs)
 - Schools
- Authority
 - RCW 43.20.050(2)(c) Adopt rules controlling public health related to environmental conditions including but not limited to heating, lighting, ventilation, sanitary facilities, cleanliness and space in all types of public facilities including but not limited to food service establishments, schools, institutions, ...
 - State Board of Health [Chapter 246-366 WAC](#):
 - [Chapter 246-366A WAC](#): Implementation prohibited by the legislature.
 - DOH / OSPI K12 Health & Safety Guide
2000, 2003 – current edition. Being updated this year.

Air Quality - Health



[Environmental Factor - May 2021: Indoor air a neglected source of chemical, particulate exposures \(nih.gov\)](https://www.nih.gov/news-events/press-releases/stories/2021/05/21_05_01)

Indoor Air Quality Principles

- Source Control
- Ventilation
 - Increases in classroom ventilation rates up to approximately **20 cfm per student** are associated with improvements in student performance
 - Increases of ventilation rates up to approximately **15 cfm per student** are associated with a higher proportion of students passing standardized reading and math tests
 - [Lawrence Berkeley National Labs Indoor Air Quality Scientific Finding Resource Bank](https://www.iaqscience.lbl.gov/performance-summary)
<https://www.iaqscience.lbl.gov/performance-summary>
- “If there is a pile of manure in the room, do not try to remove the odor by ventilation. Remove the pile of manure.”

Max Joseph Von Pettenkofer, 1818-1901

Ventilation in the Codes - These are Minimums!

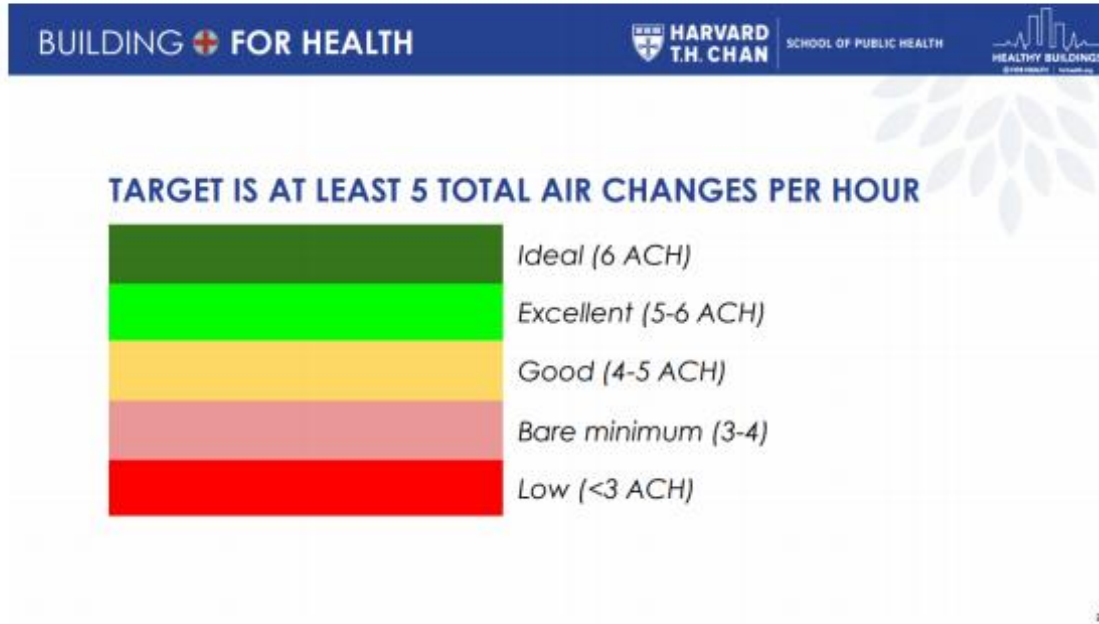
- International Mechanical Code (WAC 51-52)
- IMC ventilation requirements are based on ASHRAE 62.1
- Classrooms/computer labs: **10 cfm/person + 0.12 x square footage of room**
 - Default: 15 cfm/person
- Science, art, wood/metal shops: **10 cfm/person + 0.18 x square footage of room**
 - Default: 17 cfm/person for science labs,
19 cfm/person for art and wood/metal shops.
 - Air from these rooms may not be recirculated to other parts of the building.
- World Health Organization: **21 cfm/person**
- **Note:** ASHRAE is currently creating a standard on ventilation for the control of Infectious Aerosols (Standard 241P). It is still very drafty.

Ventilation in the SBOH Rule

WAC 246-366-080 Ventilation.

- (1) All rooms used by students or staff shall be kept reasonably free of all objectionable odor, excessive heat or condensation.
- (2) All sources producing air contaminants of public health importance shall be controlled by the provision and maintenance of local mechanical exhaust ventilation systems as approved by the health officer.

Ventilation Recommendations



<https://schools.forhealth.org/wp-content/uploads/sites/19/2020/08/Harvard-Healthy-Buildings-program-How-to-assess-classroom-ventilation-08-28-2020.pdf>

How Ventilation Systems Can Improve Air Quality

- Dilute airborne concentrations
 - particles
 - gases
- Filter out particles
 - wildfire particulates
 - Infectious aerosols
- Direct Air Movement
(negative/positive pressure, direct exhaust)

Do not add anything to the air – **Dilute and Filter!**

Key Steps - Improve Dilution

- Testing and balancing to verify you are getting the designed amount of dilution
- Setting up air distribution system to serve a fully occupied building will provide fewer people with more air volume (understand demand/control settings)
- Maximize outside air, reduce recirculated air
- Monitor CO₂ – keep below ~700 - 800 ppm if possible
- Open windows and doors when feasible

Key Steps - Improve Filtration

- ASHRAE Filter Rating of MERV **13+** in HVAC unit
- Deepest pleat possible – less resistance
- Tight fit – NO LEAKS
- Change as needed
- Not just to protect the unit –
 - **Filter the return and outside air!**
- Vacuums with HEPA filters
- Portable HEPA filter air purifiers in the nurse's office/isolation room

Portable Air Cleaners

- The CADR rating is made at the highest running speed, over sizing it to reduce noise. (Maximum of 45 dBA background noise in classrooms - [WAC 246-366-110](#))
- **Do not use ozone generators, electrostatic precipitators, plasma, UV, ionizers, or negative ion air purifiers because they can produce harmful by-products and are not necessary.**
- Look for a unit that is California Air Resources Board Certified to not produce ozone, a respiratory irritant. <https://ww2.arb.ca.gov/our-work/programs/air-cleaners-ozone-products/air-cleaner-information-consumers>
- EPA Air Cleaners and Air Filters in the Home <https://www.epa.gov/indoor-air-quality-iaq/air-cleaners-and-air-filters-home>
- Association of Home Appliance Manufacturers <https://www.ahamdir.com/room-air-cleaners/#>
- [Selection and Use of Portable Air Cleaners to Protect Workers from Exposure to SARS-CoV-2 \(nih.gov\)](https://tools.niehs.nih.gov/wetp/public/hasl_get_blob.cfm?ID=13021) https://tools.niehs.nih.gov/wetp/public/hasl_get_blob.cfm?ID=13021

Key point: If feasible, increase outside air and filtration in the building's mechanic ventilation system. If that is not feasible, **then** consider using portable air cleaning units.

NIH National Institute of Environmental Health Sciences Worker Training Program

Selection and Use of Portable Air Cleaners to Protect Workers from Exposure to SARS-CoV-2

This fact sheet provides guidance to help employers, building operators, and union officials select and use portable air cleaners to remove virus-contaminated air in indoor spaces.

Overview
Ventilation and filtration are important to prevent transmission of COVID-19. SARS-CoV-2, the virus that causes COVID-19, is mainly spread through inhalation of virus-contaminated air when an infected person speaks, laughs, coughs, sings, or sneezes. Physical distancing alone will not prevent the build-up of viral particles in a room or workspace (Figure 1).

Figure 1: For transmission to occur via tiny airborne particles, three things are necessary: source, pathway, and recipient!

Approximately 40% of people who are infectious are asymptomatic (no symptoms) or presymptomatic (before symptoms begin) and may contaminate air unknowingly. Work settings with inadequate ventilation and/or those that require people to be close together for extended periods of time, increase the risk of COVID-19 transmission. The illustration at right outlines the recommended steps to improve ventilation in buildings (Figure 2).

Figure 2: Illustration of the order in which to consider improvements to ventilation in buildings.¹

Footnote 1: Based on an image from the Center for Infectious Disease Research and Policy. <https://www.cidrpi.org/essential-workers>

Footnote 2: Source: Jones et al. 2020. Schools for Health, Risk Reduction Strategies for Reopening Schools. Harvard Healthy Buildings Program.

Cooling Indoor Spaces Without Air Conditioning (wa.gov)

Severe heat may cause illness or even death. When temperatures rise to extreme highs, you can reduce risks by taking steps to create cooling even when air conditioning is not available. This cooling can be accomplished in a manner that minimizes pushing air across the breathing zone of building occupants, which reduces the risk of spreading airborne diseases.

- Pull the shades on any windows that get sun, including doors with windows. Keep shades pulled from early in the morning until sunlight is no longer hitting the window.
- Open shades at night, which allows windows to radiate heat outward.
- When selecting shades, choose light colors because they are more effective at reflecting visible wavelengths of light that generate heat. Also choose shades that completely cover the window or door and have a close fit.
- Use fans to create cooling only if the air temperature is less than ~99°F.
- Open windows when the outside air temperature is cooler if the air quality is safe.
- Limit use of heat generating electronics and lights.

Preventative Maintenance is KEY



When filter changes aren't timely

- Lack of air flow/IAQ complaints
- Harder to pull air through them
- HVAC fans can burn out

Changing filters is cheaper than replacing fans!

When fan belts break:

- Fan doesn't work- lack of air flow
- IAQ complaints
- Lack of confidence in maintenance



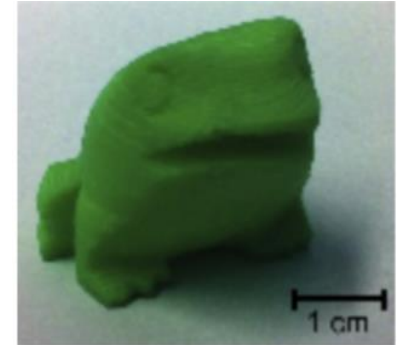
Keep buses ventilated!

- At a minimum, open the front two windows and the second to last two windows at least a few inches.
- Do not “fog” buses with chemicals. Clean with a third party certified fragrance-free cleaner.
- Disinfect when there is blood, feces, or vomit. Then thoroughly air out the bus.



3D Printers

- Heated thermoplastic extrusion/deposition
- Significant aerosol emission potential
 - “High emitters” of ultrafine particles
 - Gases/fumes
 - Heavy metals
- Provide exhaust ventilation
- [WAC 246-366-080](#): “(2) All sources producing air contaminants of public health importance shall be controlled by the provision and maintenance of local mechanical exhaust ventilation systems as approved by the health officer.”
- [Using 3D Printers Safely \(wa.gov\)](#)



Keeping Smoke Out



- Close up building, restrict entry
 - “air lock” entries with plastic sheeting
 - Large air scrubbers near entries
- Increase filtration efficiency – MERV 13
 - Secondary charcoal filter
- Change filters more frequently
- Keep buildings under positive air pressure
- Monitor CO₂
- Problems
 - Univentilators
 - Buildings with only windows for ventilation
- New/remodel: Separate ventilation from heating/cooling/energy recovery. Bring in outside air through a minimum MERV 13. DOAS - Dedicated OA Systems.
- *DOH: Improving Ventilation & IAQ during WFS Events*
 - <https://www.doh.wa.gov/Portals/1/Documents/Pubs/333-208.pdf>

RESOURCES

Wildfires and Indoor Air Quality in Schools and Commercial Buildings | Indoor Air Quality (IAQ) | US EPA

- Actions that should be taken before and during a smoke event,
- A checklist to determine if the HVAC system is ready for a smoke event,
- Information on how to properly use portable air cleaners,
- An overview of how to determine the safe operation of HVAC systems when using higher efficiency air filters, and
- References and additional resources.

Ventilation and Air Quality for Reducing Transmission of Airborne Illnesses

- Post COVID Ventilation guidance from DOH
- Good ventilation and indoor air quality are important in reducing airborne exposure to viruses and other disease vectors, chemicals, and odors. Buildings vary in design, age, heating, ventilation, and air conditioning (HVAC) systems, and their ability to provide adequate ventilation and air filtration.
- Because each building and its existing HVAC systems will be different, consult a professional engineer or HVAC specialist to determine the best way to maximize the system's ventilation and air filtration capabilities for each specific room in the building. For more detailed guidance, see the [Clean Air in Buildings Challenge](#), EPA (PDF)

General Considerations

[Ventilation and Air Quality for Reducing Transmission of Airborne Illnesses \(wa.gov\)](https://www.wa.gov)

- Upgrade filters to MERV 13 if the system can handle the air resistance.
- Change filters as needed. Clogged filters decrease HVAC operation, stress the fan motors, and decrease their ability to improve indoor air quality. Visually inspect monthly.
- Reduce recirculation of indoor air, maximize outside air.
- Monitor CO2 levels with the goal of keeping levels below 800 ppm.
- Maintain humidity of 40 to 60 percent.
- Ventilate the building 1 hour before occupancy and 2 hours after custodial activities.
- Inspect and maintain local exhaust ventilation in restrooms, kitchens, cooking areas, and labs. Increase exhaust ventilation from restrooms above code minimums.
- Work with building engineer or HVAC specialist to generate air movement that goes from clean-to-less-clean air by positioning air supply and exhaust air dampers.

Buildings that DO NOT have an Existing HVAC System

[Ventilation and Air Quality for Reducing Transmission of Airborne Illnesses \(wa.gov\)](https://www.wa.gov)

- Open windows and doors to create a cross draft. Even a few inches of opening will help with ventilation.
- Reduce occupancy in areas where outdoor ventilation cannot be increased to the optimal amount.
- Use fans to increase the effectiveness of open windows. Position fans securely and carefully in or near windows. Window fans positioned to blow air out of a window can help draw fresh air into the room through other open windows and doors.
- Using fans for cooling is acceptable.
- Avoid blowing respiratory aerosols from one person to another.

Portable Air Filtration

[Ventilation and Air Quality for Reducing Transmission of Airborne Illnesses \(wa.gov\)](https://www.wa.gov)

- Portable HEPA air cleaners can supplement ventilation and are most critical in rooms with poorer ventilation or in isolation areas.
- Unit air ratings are based on the square footage of the room and the Clean Air Delivery Rate (CADR). Harvard's School of Public Health offers a guide to calculate ventilation rates for indoor spaces.
- The equivalent of at least 5–6 air changes per hour is recommended.
- Consider the noise rating because some units can be quite loud. Consult with the manufacturer before purchasing. The CADR is at the highest speed, which will be too loud for some environments. Choose one rated for a larger room and run it on the low fan speed to reduce the noise or use two air cleaners for the room.
- The ventilation system should run 1 hour before and 2 hours after occupancy.
- When selecting a portable air cleaner, check to ensure that it is California Air Resources Board certified. This means that it emits little or no ozone.
- Do not use ozone generators, electrostatic precipitators and ionizers, or negative ion air purifiers because they can produce harmful by-products.
- Replace HEPA filters regularly as recommended by the manufacturer. The unit should be vacuumed and cleaned on a regular schedule; do this outside. Filter disinfection is not needed or recommended.

Additional Considerations

[Ventilation and Air Quality for Reducing Transmission of Airborne Illnesses \(wa.gov\)](https://www.wa.gov)

Restrooms:

- Ensure restroom exhaust fans are functional and operate at full capacity during occupancy.
- Install paper towels to dry hands, disconnect hand dryers (blowers).
- Ensure that all drain traps are primed (water flow maintained regularly).

Clean Air in Buildings Challenge (epa.gov)

1. CREATE AN ACTION PLAN FOR CLEAN INDOOR AIR IN YOUR BUILDING(S) that assesses IAQ, plans for upgrades and improvements, and includes HVAC inspections and maintenance.
 - Commissioning, Testing, Balancing
2. OPTIMIZE FRESH AIR VENTILATION by bringing in and circulating clean outdoor air indoors.
 - Properly use economizers
3. ENHANCE AIR FILTRATION AND CLEANING using the central HVAC system and in-room air cleaning devices.
 - MERV 13
4. GET YOUR COMMUNITY ENGAGED IN YOUR ACTION PLAN by communicating with building occupants to increase awareness, commitment, and participation in improving indoor air quality and health outcomes.

Improving Ventilation In Buildings

[Improving Ventilation In Buildings | CDC](#)

What You Need to Know

- To improve ventilation in your building, keep your system operating as designed. Aim for at least 5 air changes each hour and upgrade to MERV-13 filters.
- Good ventilation is essential to maintaining a healthy indoor environment and protecting building occupants from respiratory infections.
- Improving [ventilation in buildings](#) can help reduce the number of viral particles in the air and lower occupants' risk of exposure to respiratory viruses.
- Implementing multiple infection prevention and control strategies at the same time can increase the overall effectiveness of ventilation interventions.
- Building owners and operators can participate in the [Clean Air in Building Challenge](#) to improve indoor air quality and protect public health.

THANK YOU!

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Questions and Answers



WASHINGTON STATE UNIVERSITY
Energy Program

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