

Better Breathing: Post Pandemic Protocols for Better IAQ

Wednesday, March 9, 2022

Luke Leung, PE
Skidmore, Owings & Merrill

- **Housekeeping**
- **Better Breathing: Post Pandemic Protocols for Better IAQ**
- **Ameren Illinois Energy Efficiency Program Overview**
- **Questions**

Better Breathing: Post Pandemic Protocols for Better IAQ



SOM

LUKE LEUNG, P ENG, PE, LEED FELLOW, ASHRAE FELLOW

Acknowledgement:

Bill Bahnfleth
ASHRAE ETF

**What does the
future hold?**



An aerial photograph of a city skyline, likely Los Angeles, with a dense forest in the foreground and mountains in the background. The text "2. Non Communicable Diseases" is overlaid in white, bold, sans-serif font.

2. Non Communicable Diseases

A nighttime photograph of a city, likely Los Angeles, with its lights visible in the foreground. In the background, a large, intense fire is burning on a hillside, with thick smoke rising into the dark sky. The fire is the central focus of the image, with its bright orange and yellow flames contrasting sharply with the dark surroundings.

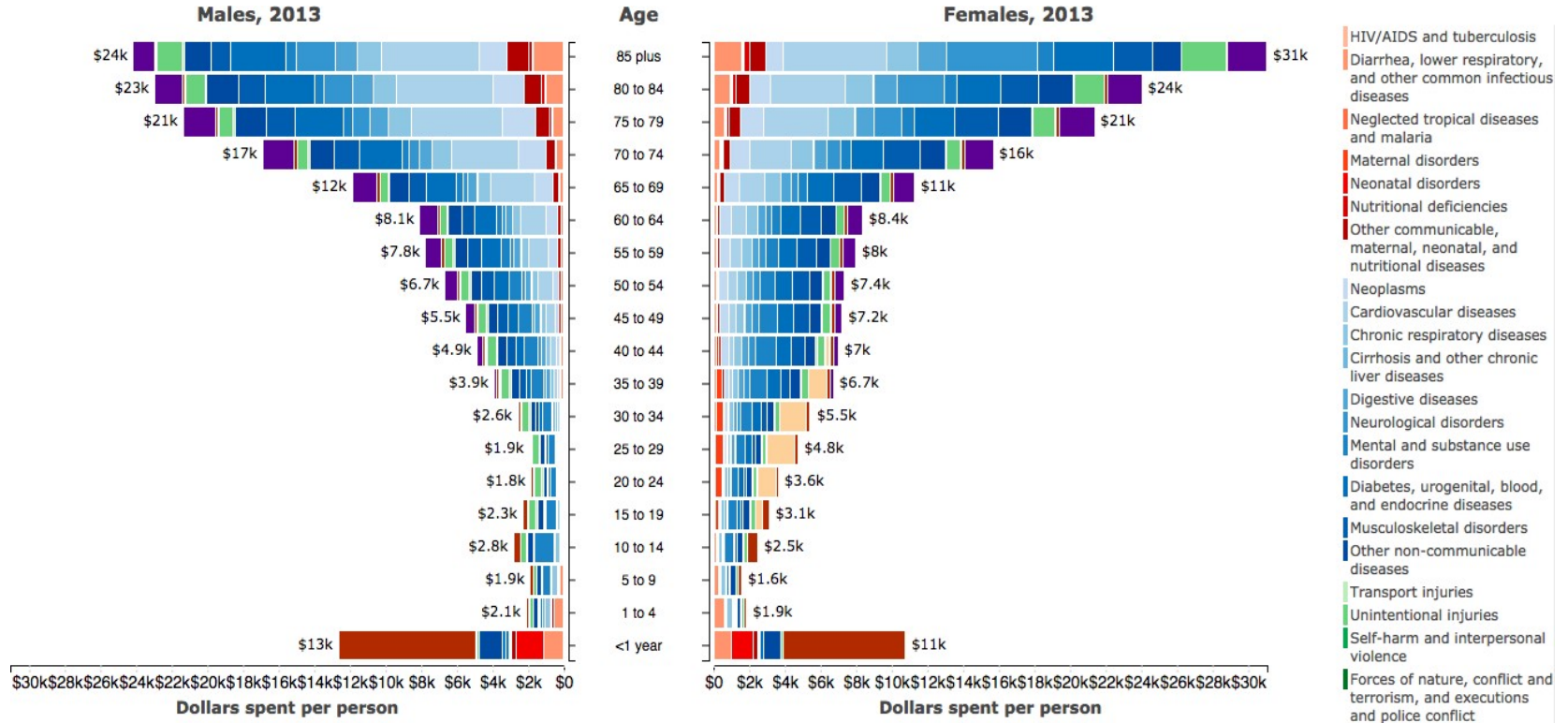
1. Climate Change

2020: 7.8 Billion

2070: 9.4 Billion

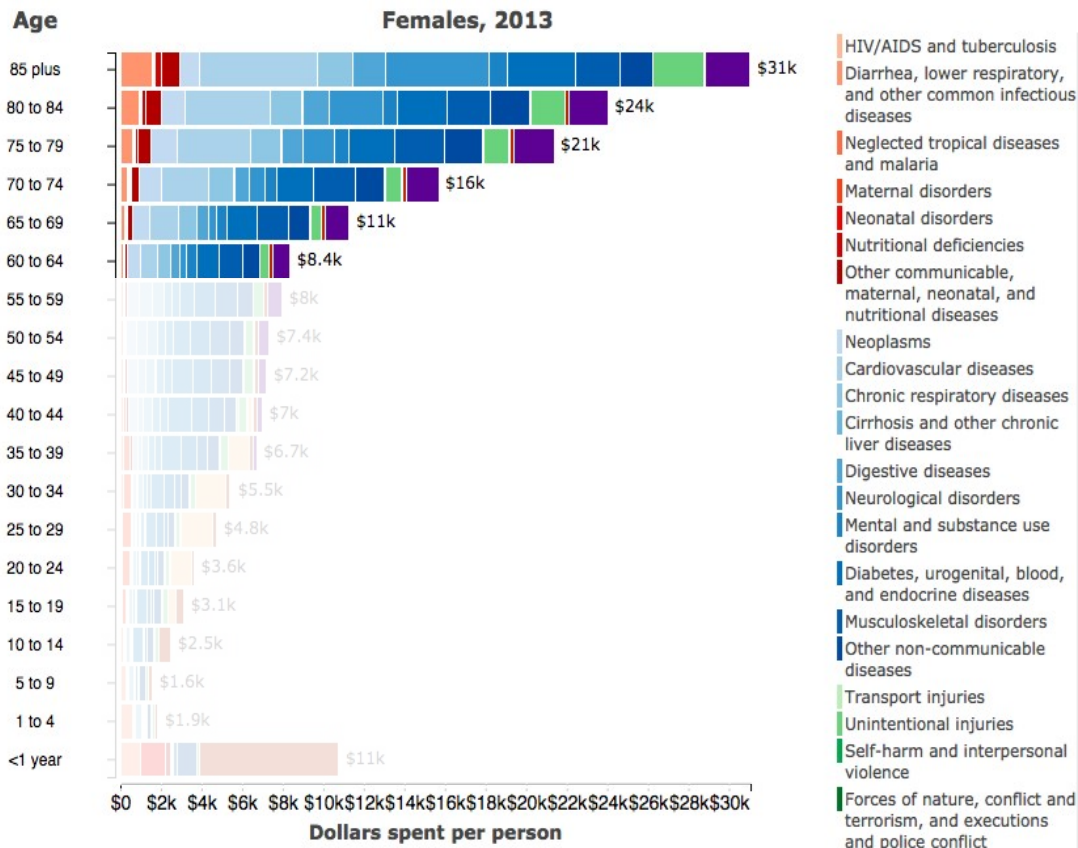
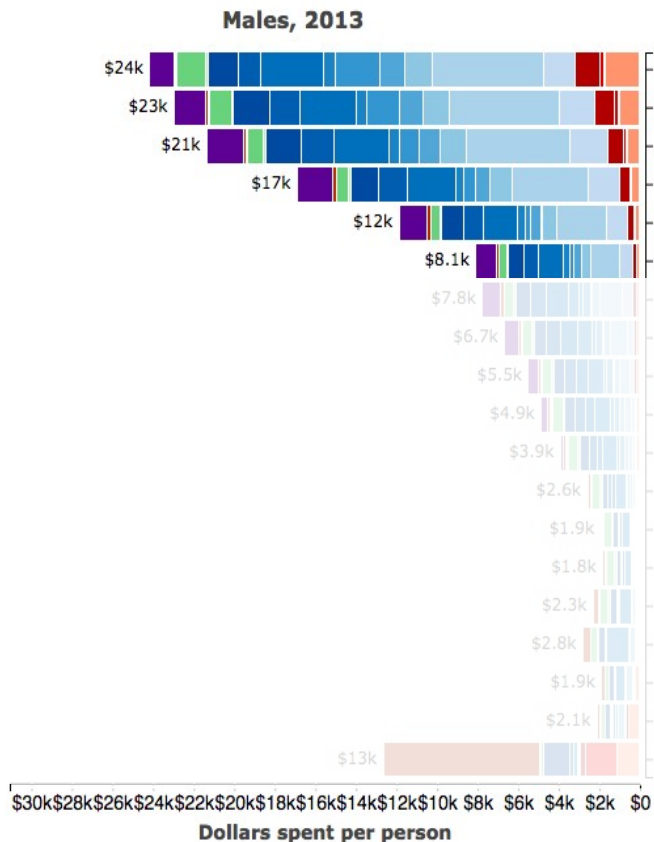
HEALTH AND WELLNESS – COST (ENERGY)

US HEALTH SPENDING

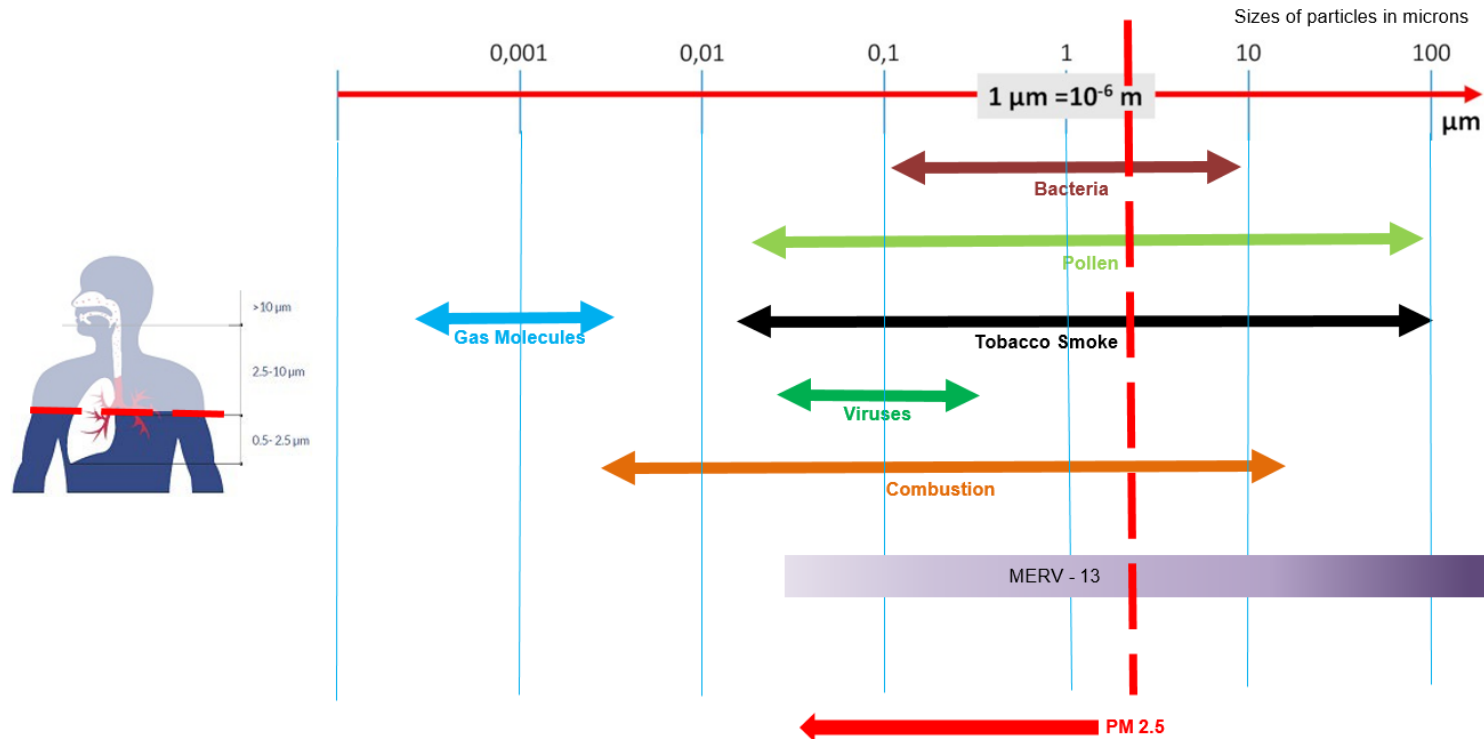


HEALTH AND WELLNESS – COST (ENERGY)

US HEALTH SPENDING



WHAT IS IN THE AIR?



A more equitable future?

EQUITY - RISK FOR COVID-19 INFECTION, HOSPITALIZATION, AND DEATH

Risk for COVID-19 Infection, Hospitalization, and Death By Race/Ethnicity				
Rate ratios compared to White, Non-Hispanic persons	American Indian or Alaska Native, Non-Hispanic persons	Asian, Non-Hispanic persons	Black or African American, Non-Hispanic persons	Hispanic or Latino persons
Cases ¹	1.9x	0.7x	1.1x	1.3x
Hospitalization ²	3.7x	1.1x	2.9x	3.2x
Death ³	2.4x	1.0x	1.9x	2.3x

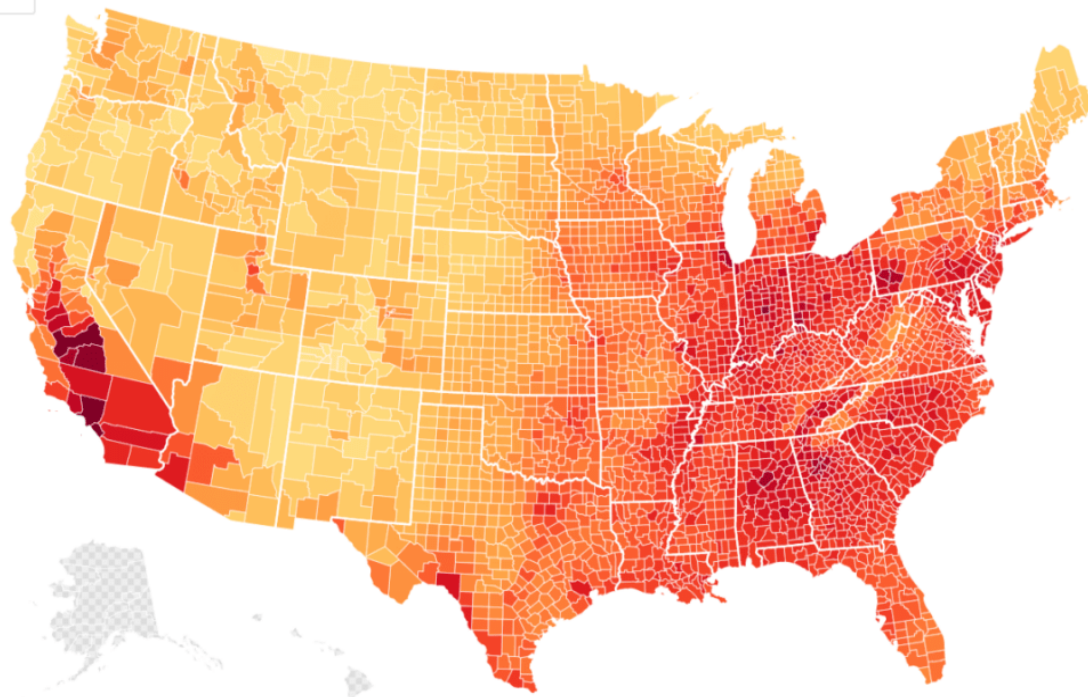
Race and ethnicity are risk markers for other underlying conditions that affect health, including socioeconomic status, access to health care, and exposure to the virus related to occupation, e.g., among frontline, essential, and critical infrastructure workers.

EQUITY – POOR AIR QUALITY FOR 40% OF AMERICANS

PM 2.5 2010-1016

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Search..



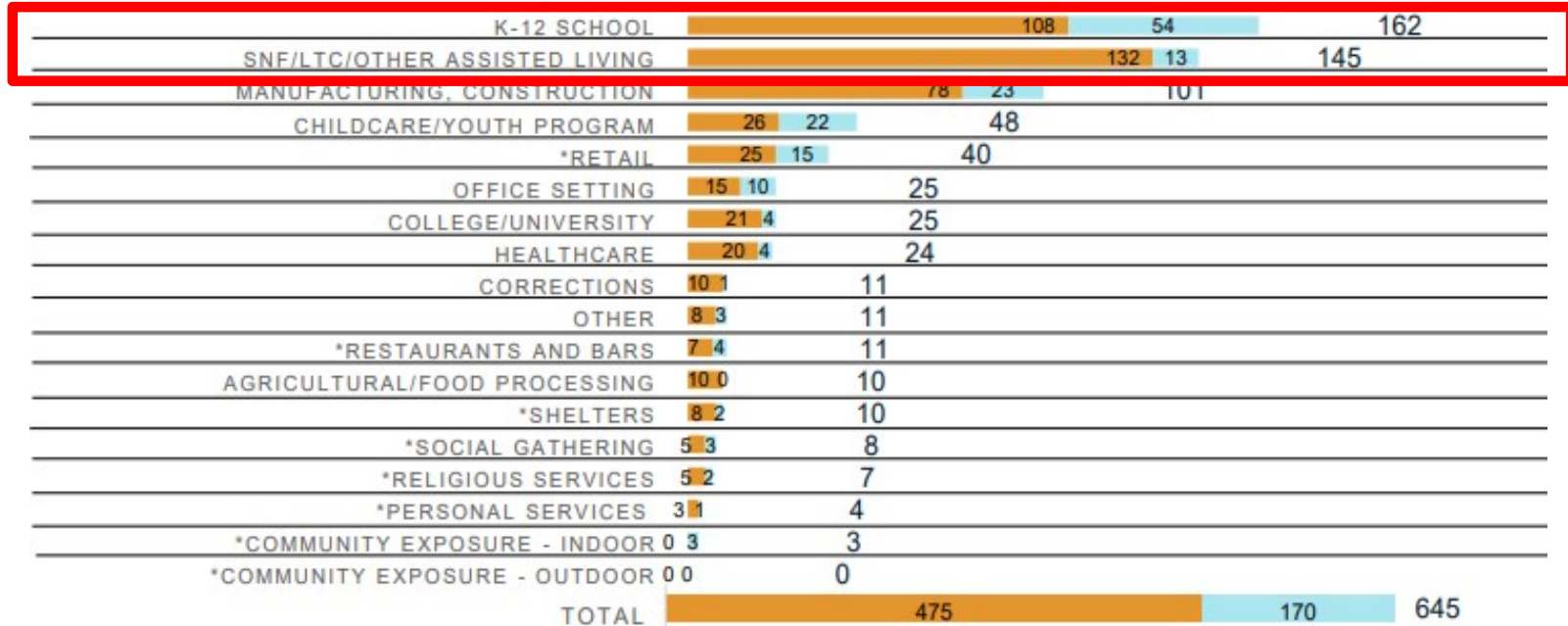
Source: FindCare, Wu et al. 2020, U.S. Census Bureau • Alaska and Hawaii are not included in the study.

People of color are 3 times more likely to live in poor quality air areas.

EQUITY - MICHIGAN, MARCH 11, 2021

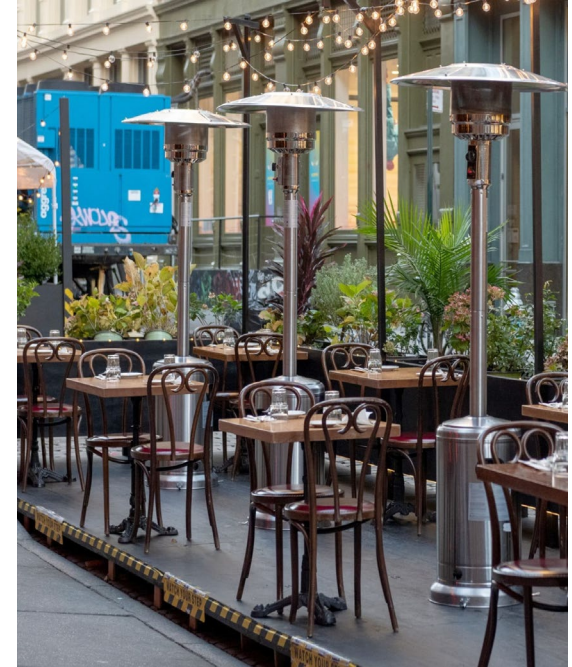
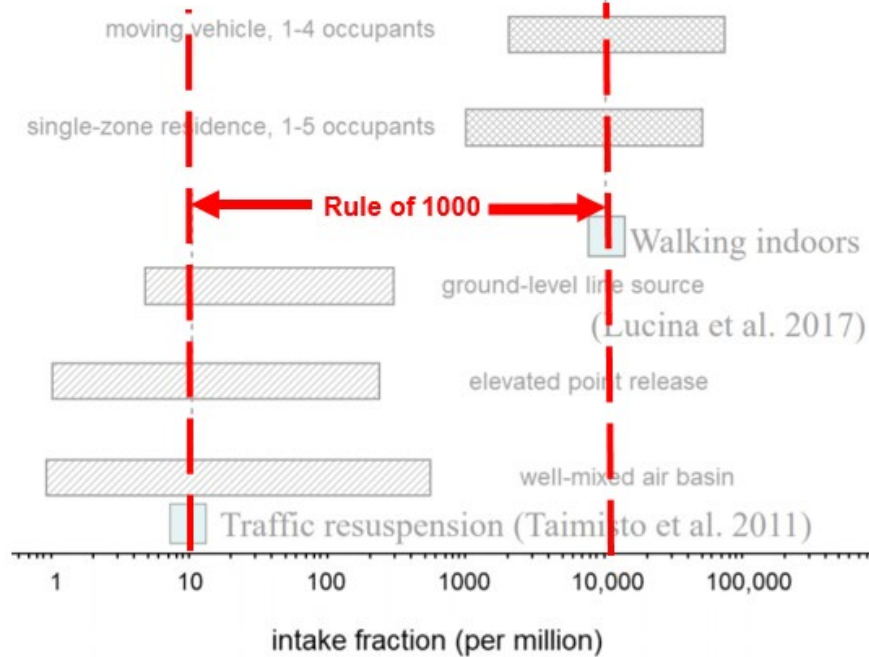
Site type Outbreaks by ongoing/new classification, #

■ Ongoing ■ New Total



1. Inside Out

RULE OF "1000", MAKE SURE AIR IS HOLISTICALLY BETTER



SOURCE: Lai, Thatcher, Nazaroff, 2000



2. Core Recommendations

CORE RECOMMENDATIONS (1/6/2021)

- Concise summary of ASHRAE guidance
- Documents current status of ASHRAE guidance
- *Significantly* different from spring/summer 2020
- Defines a flexible approach that allows for adaptation to local circumstances
 - ❑ Technical feasibility
 - ❑ Construction budget
 - ❑ Energy and operating cost
 - ❑ Indoor environment control



ASHRAE EPIDEMIC TASK FORCE

Core Recommendations for Reducing Airborne Infectious Aerosol Exposure

The following recommendations are the basis for the detailed guidance issued by ASHRAE Epidemic Task Force. They are based on the concept that within limits ventilation, filtration, and air cleaners can be deployed flexibly to achieve exposure reduction goals subject to constraints that may include comfort, energy use, and costs. This is done by setting targets for equivalent clean air supply rate and expressing the performance of filters, air cleaners, and other removal mechanisms in these terms.

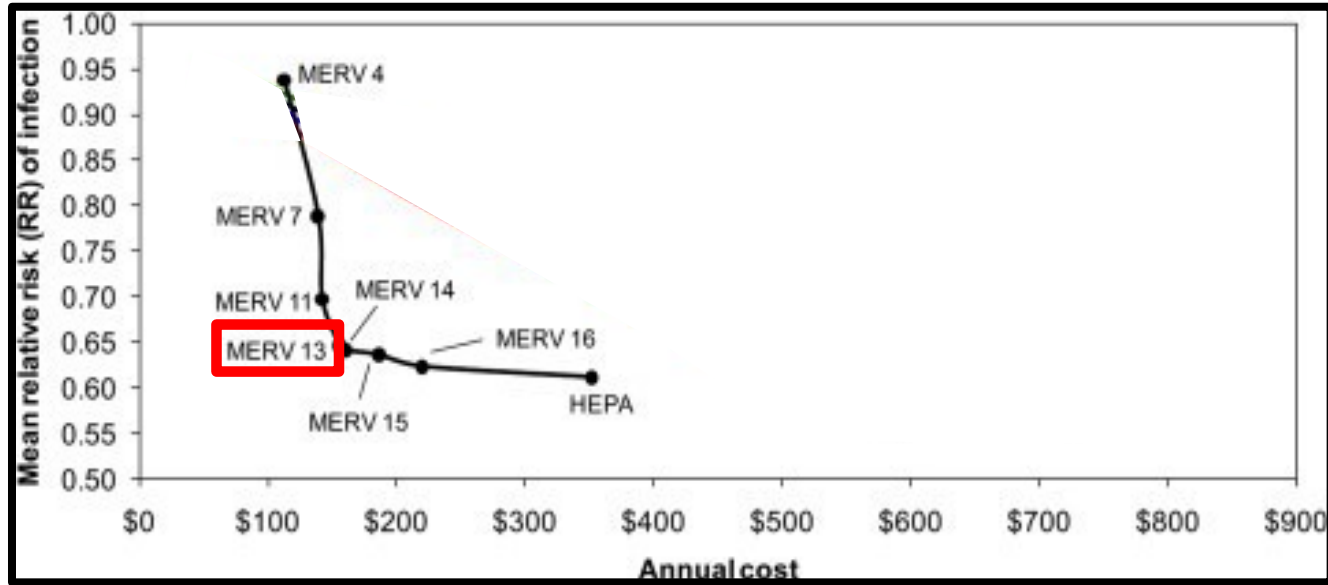
1. *Public Health Guidance* - Follow all regulatory and statutory requirements and recommendations for social distancing, wearing of masks and other PPE, administrative measures, circulation of occupants, reduced occupancy, hygiene, and sanitation.
2. *Ventilation, Filtration, Air Cleaning*
 - 2.1 Provide and maintain at least required minimum outdoor airflow rates for ventilation as specified by applicable codes and standards.
 - 2.2 Use combinations of filters and air cleaners that achieve MERV 13 or better levels of performance for air recirculated by HVAC systems.
 - 2.3 Only use air cleaners for which evidence of effectiveness and safety is clear.
 - 2.4 Select control options, including standalone filters and air cleaners, that provide desired exposure reduction while minimizing associated energy penalties.
3. *Air Distribution* - Where directional airflow is not specifically required, or not recommended as the result of a risk assessment, promote mixing of space air without causing strong air currents that increase direct transmission from person-to-person.
4. *HVAC System Operation*
 - 4.1 Maintain temperature and humidity design set points.
 - 4.2 Maintain equivalent clean air supply required for design occupancy whenever anyone is present in the space served by a system.
 - 4.3 When necessary to flush spaces between occupied periods, operate systems for a time required to achieve three air changes of equivalent clean air supply.
 - 4.4 Limit re-entry of contaminated air that may re-enter the building from energy recovery devices, outside air intakes, and other sources to acceptable levels.
5. *System Commissioning* - Verify that HVAC systems are functioning as designed.

ashrae.org/covid19

2. VENTILATION, FILTRATION, AIR CLEANING: OUTDOOR AIR

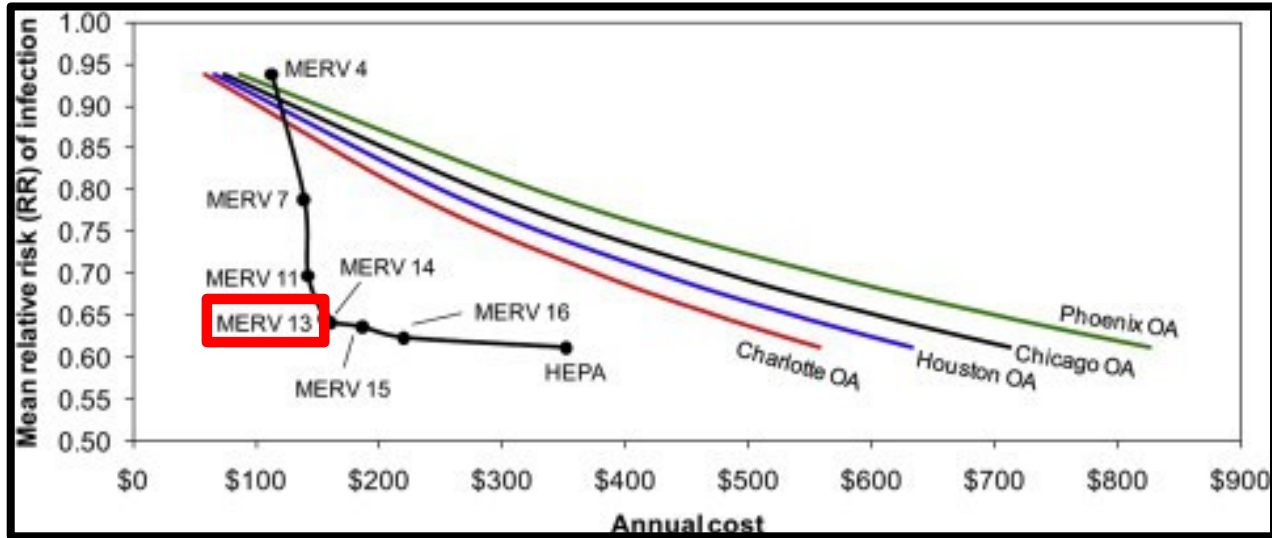
- ***2.1 Provide and maintain at least required minimum outdoor airflow rates for ventilation as specified by applicable codes and standards.***
- Importance
 - Early guidance recommended maximizing outdoor air flow – multiple issues
 - Other controls may be equally effective and better in other respects
 - Code minimum ventilation should be mandatory for general air quality control

100% OUTSIDE AIR VERSUS FILTRATION



P. Azimi and B. Stephens, "HVAC filtration for controlling infectious airborne disease transmission in indoor environments: Predicting risk reductions and operational costs," 04 09 2013. [Online]. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7127325>

100% OUTSIDE AIR VERSUS FILTRATION



MERV 13

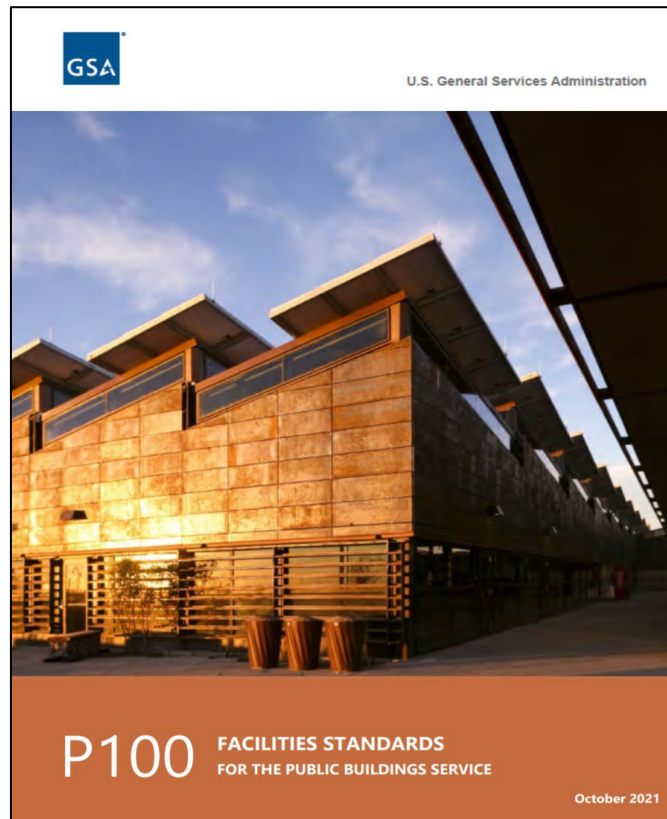
- Pressure Drop
- First Cost - \$0.025/CFM

TEST ORDER	FILTER TYPE	PRESSURE DROP (IN. W.G.)	PRESSURE DROP (PA)	CORRECTED UPSTREAM COUNTS (#)	CORRECTED DOWNSTREAM COUNTS (#)	SINGLE-PASS EFFICIENCY
14	MERV 5	0.16	39	197	118	40%
20	MERV 5	0.18	45	87	53	39%
21	MERV 5	0.18	45	86	57	34%
22	MERV 5	0.17	43	82	57	30%
23	MERV 5	0.18	44	115	83	28%
24	MERV 5	0.17	42	136	120	12%
5	MERV 13	0.18	44	150	31	79%
6	MERV 13	0.16	40	138	29	79%
7	MERV 13	0.16	39	111	4	96%
8	MERV 13	0.17	42	106	9	92%
15	MERV 13	0.19	48	165	16	90%
17	MERV 13	0.22	54	44	1	98%
9	MERV 14	0.21	53	73	2	97%
10	MERV 14	0.24	61	107	5	95%
11	MERV 14	0.24	61	214	2	99%
12	MERV 14	0.24	59	183	6	97%
13	MERV 14	0.24	61	168	4	98%

MERV 13 filters

- 100% recirculation air terminal units
- fan coil units
- fan powered boxes.
- final filters for all central air handling units and DOAS/ERVs.
- Smoke Migration Risk from Wildfires, permanent filter rack

<https://www.gsa.gov/cdnstatic/P100%202021%20v1.pdf>



2. VENTILATION, FILTRATION, AIR CLEANING: FILTRATION

- *2.2 Use combinations of filters and air cleaners that achieve MERV 13 or better levels of performance for air recirculated by HVAC systems.*
- Importance
 - Minimum standard filters are not effective for infectious aerosols
 - HEPA filters in equipment are an expensive retrofit
 - MERV 13 has good efficiency for respiratory aerosols
 - Allows trade-offs when MERV 13 mechanical filter is not feasible

EQUIVALENT OUTDOOR AIR:



Name of Space / AHU / Building	Units	Sample - Space
Outdoor Air ACH	ACH	1.56
Cental AHU Filter MERV Rating	MERV	7
UVC Single Pass Inactivation	%	85.00%

EQUIVALENT OUTDOOR AIR:

Name of Space / AHU / Building	Units	Sample - Space
Area	Sq Ft	900
Average Ceiling Height	Ft	9
Volume	Cu Ft	8100
Total Supply Air	CFM	1000
Total Outdoor Air	CFM	210
Supply Air ACH	ACH	7.41
Outdoor Air ACH	ACH	1.56
Cental AHU Filter MERV Rating	MERV	7
UVC Single Pass Inactivation	%	85.00%
ACH_OA	ACH	1.56
ACH_f	ACH	2.08
ACH_e,c	ACH	3.20
ACH_ir	ACH	0.00
Time Required to achieve target Air Changes		3
Hours	Hours	0.44

IMPORTANT!

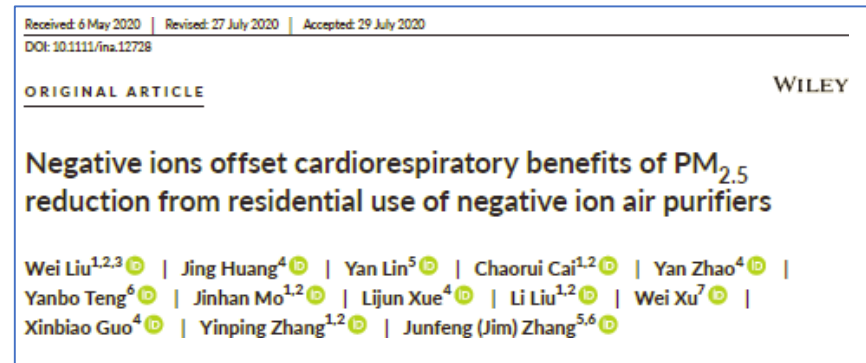
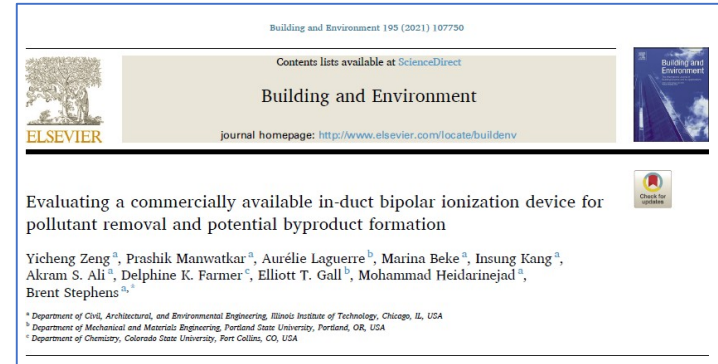
Code minimum ventilation + MERV 13 filtration
may not provide adequate risk mitigation.

Additional control may be required.

2. VENTILATION, FILTRATION, AIR CLEANING: AIR CLEANERS

- **2.3 Only use air cleaners for which evidence of effectiveness and safety is clear.**

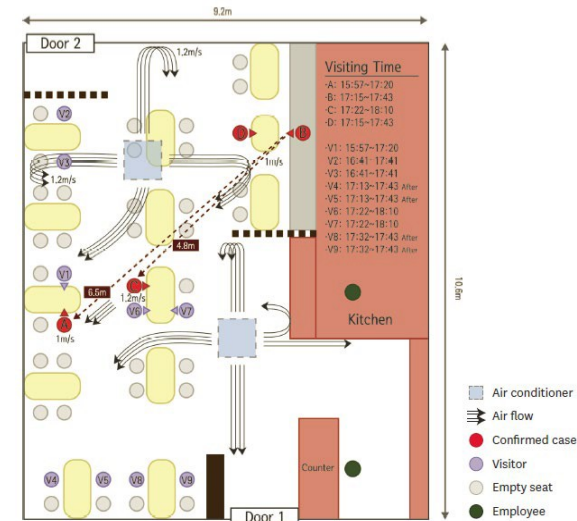
- Importance
 - Effectiveness and safety of many products is not well established
 - ASHRAE believes germicidal ultraviolet effectiveness and safety is demonstrated
 - User must evaluate manufacturers' claims and data carefully



3. AIR DISTRIBUTION, MIXING, DRAFTS

- *Where directional airflow is not specifically required, or not recommended as the result of a risk assessment, promote mixing of space air without causing strong air currents that increase direct transmission from person-to-person.*

- Why it's important
 - Strong drafts can move large infectious aerosol droplets long distances
 - Stratified ventilation can trap infectious aerosols and increase risk

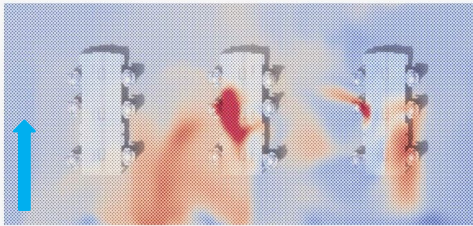
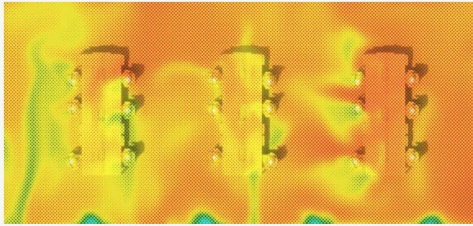


J Korean Med Sci. 2020 Nov 30;35(46):e415
<https://doi.org/10.3346/jkms.2020.35.e415>

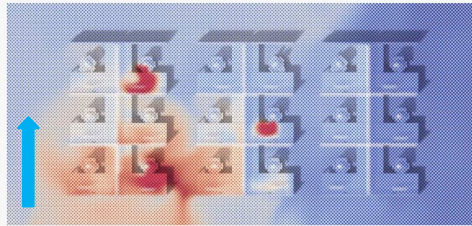
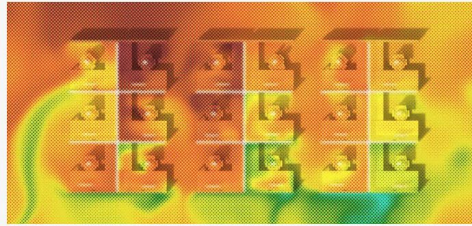


Li, Y., P. Nielsen, M. Sandberg. 2011. ASHRAE J. 53(6): 86-88

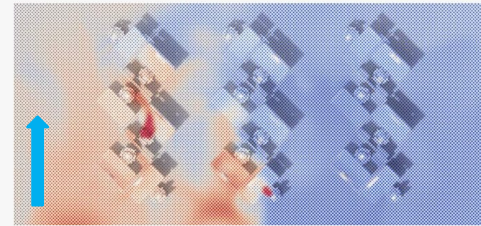
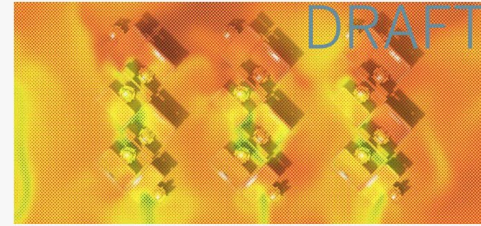
3. AIR DISTRIBUTION, MIXING, DRAFTS – FURNISHING MATTERS



Configuration 1: Row Seating



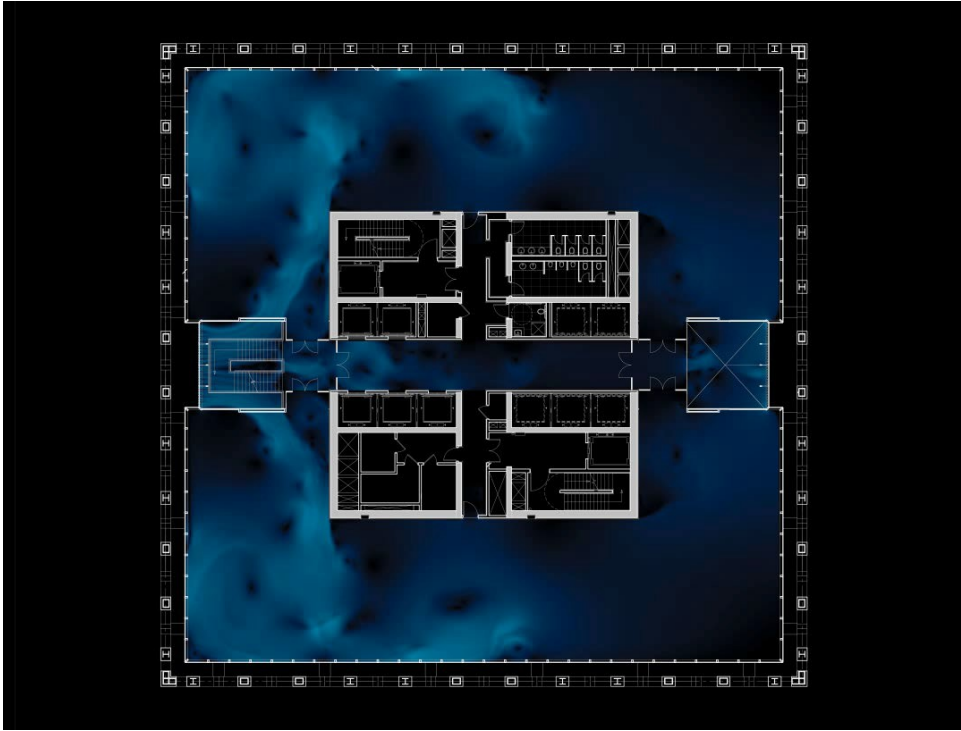
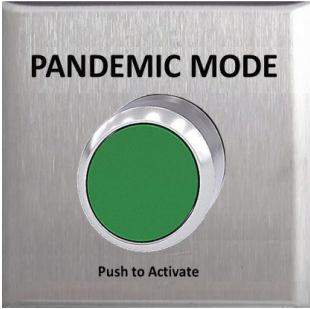
Configuration 2: Cubicle Seating



Configuration 3: Rotated Seating

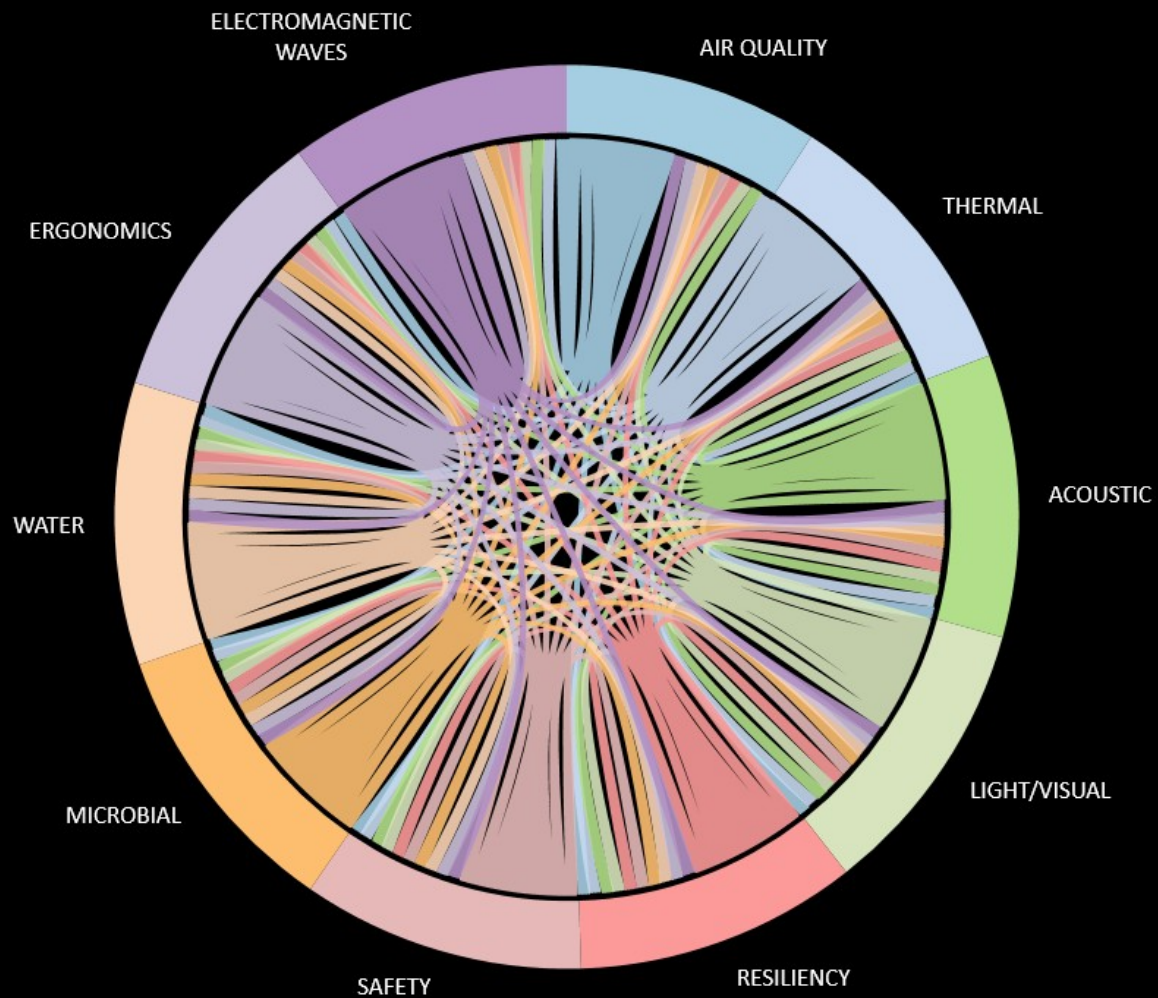
3. Control and Monitoring

MONITORING VIRUS



4. Beyond IAQ

IAQ TO IEQ





Thank You!

Luke Leung
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A man with short dark hair and a light beard, wearing a dark blue V-neck sweater, is looking down at a white smartphone he is holding in his right hand. The background is a bright, out-of-focus window with multiple panes.

Ameren Illinois Energy Efficiency Program Overview

Business Incentives Overview



Lighting

- ▶ Interior & Exterior LED Lighting
- ▶ Small Business
- ▶ Municipality-Owned Street Lighting
- ▶ Ameren-Owned Street Lighting
- ▶ Shop Our Online Store



Instant Incentives

- ▶ Instant Incentives (LEDs, Smart Thermostats, Notched V-Belts, CACs, HPWHs, ASHPs)



Heating, Cooling & Ventilation

- ▶ Ground Source Heat Pumps
- ▶ Heating & Cooling
- ▶ Smart Thermostats
- ▶ Steam Traps
- ▶ Variable Frequency Drives
- ▶ Ventilation
- ▶ Water Heating



Specialty

- ▶ Compressed Air Systems
- ▶ Custom Projects
- ▶ Feasibility Study
- ▶ Metering & Monitoring
- ▶ Pumps, Motors & Drives
- ▶ Retro Commissioning
- ▶ Specialty Equipment



Refrigeration

- ▶ Commercial Refrigeration
- ▶ Small Business



Construction

- ▶ New Construction

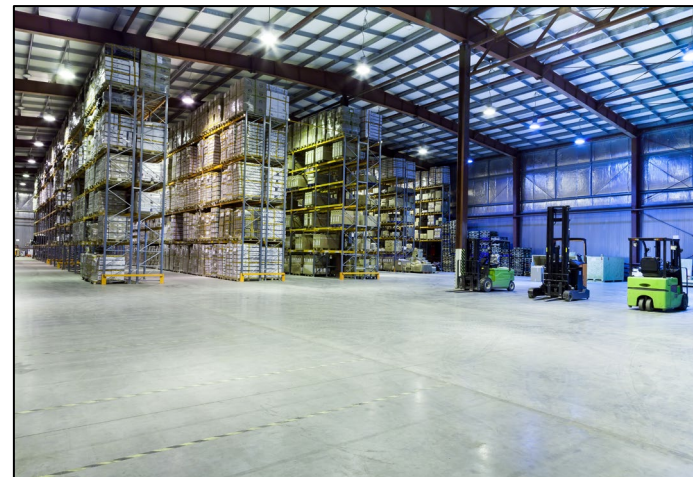


Water-Saving Devices

- ▶ Faucet Aerators
- ▶ High-Efficiency Shower Heads
- ▶ Laminar Flow Devices

Business Incentives Overview

- Instant Incentives
 - Receive an instant incentive when purchasing from participating Distributors
 - LED's, Smart Thermostats, Notched V-Belts
 - HVAC equipment
- Online Store
- Small Business Direct Install
- Custom
- Retro Commissioning
- Street Lighting
- Networked Lighting Controls
- Advanced Rooftop Unit Controls



A man with short dark hair and a light beard, wearing a dark blue V-neck sweater over a grey shirt, is looking down at a white smartphone he is holding in his right hand. The background is a bright, out-of-focus window with multiple panes.

Incentive Bonuses in 2022

Early Completion Bonus



- Receive extra incentive dollars for completing your project early!
- Customer Early Completion Bonus for both gas & electric projects
- No additional paperwork, bonus automatically added
- ***AmerenIllinoisSavings.com/Bonus***
- Not applicable to Online Store, Instant Incentives, Midstream HVAC/HPWH Offerings, Small Business Direct Install Projects, Staffing Grant, Strategic Energy Management (SEM), Metering & Monitoring, Feasibility Study, or Building Energy Assessment (BEA)

BONUS AMOUNT:	PROJECT COMPLETED BY:
15%	March 31
10%	June 30
5%	Sept. 30

What's New in 2022

Made In Illinois Bonus

- 5% Bonus incentive for using equipment made in Illinois
- Equipment must be at least 50% manufactured and/or assembled in Illinois
 - Exclusive of packaging and Installation
 - Product installation is not considered “assembly”
- Must provide documentation that equipment meets eligibility
- Project must be completed between Jan. 1, 2022, and Sept. 30, 2022
- ***AmerenIllinoisSavings.com/Bonus***

  ENERGY EFFICIENCY PROGRAM	
BONUS AMOUNT:	PROJECT COMPLETED BY:
20%	March 31
15%	June 30
10%	Sept. 30

Summer Break Bonus

- 10% Incentive Bonus
- K-12 and Community Colleges eligible
- Projects must be completed by August 31, 2022
- Made In Illinois Bonus does not apply
- ***AmerenIllinoisSavings.com/Break***



Public Sector: Local Government, Public Schools, Community Colleges

- Public HVAC/Water Heaters Application
- Public Equipment Hospitality Application
- Municipal-Owned Streetlights Application (also muni parking lots)
- Local Government includes villages, cities, counties, public water, mass transit, airport, park, hospital & library districts, police & fire stations

State, Federal and State Universities

- Use Private Standard Applications
- Custom incentive application receives enhanced Public incentive

Bonuses

- All Public Sector Customers eligible for the Early Completion Bonus & Made in Illinois Bonus (when applicable)
- Public Schools & Community Colleges eligible for 10% Summer Break Bonus for projects completed by 8/31/22

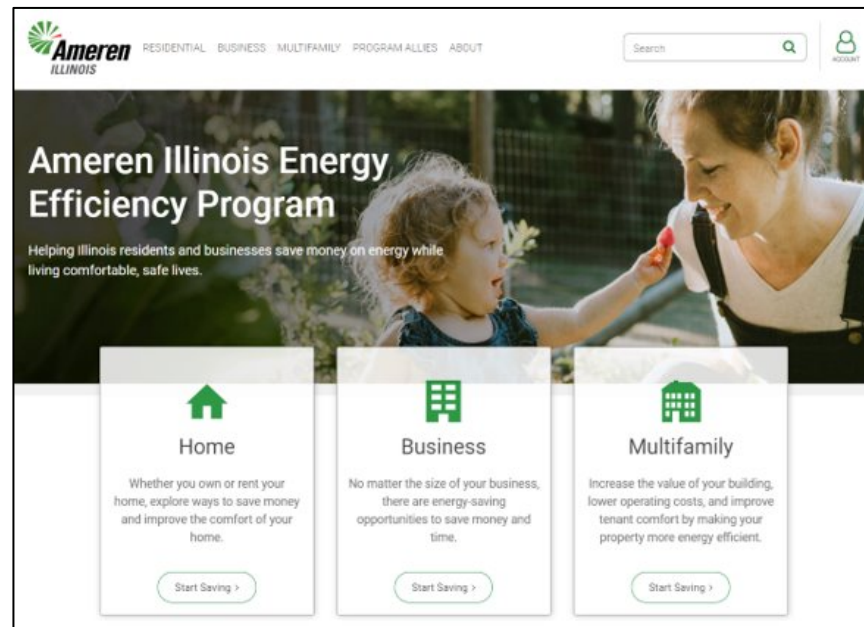
New Measures!

- Advanced Rooftop Controls
- Enhanced incentives for Networked Lighting Controls
- Commercial Grow Lighting
- Telecom Data Center application
- Ground-Source Heat Pump incentives



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- Find applications, guides, other necessary forms
- View videos, case studies, and other educational content
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- Online store
- Energy Advisors
- Program Ally's



- Friendly, knowledgeable staff are able to answer your questions quickly or refer you to the right person
- Can help verify customer eligibility
- **BUS: 1.866.800.0747**



QUESTIONS?





For My Business

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