

Next Era: Epidemic, Election, Emission

Luke Leung, PE, LEED Fellow

ASHRAE Epidemic Task Force



ASHRAE Epidemic Task Force

Guide to the COVID-19 Pages

Follow the links on the Infographic

LEARN MORE

Questions Answered

Frequently Asked Questions and Glossary of Terms

FAQ / GLOSSARY


This page is updated as new information becomes available.

 Main

 Reopening

 Buildings

 Filtration/Disinfection

 Transportation

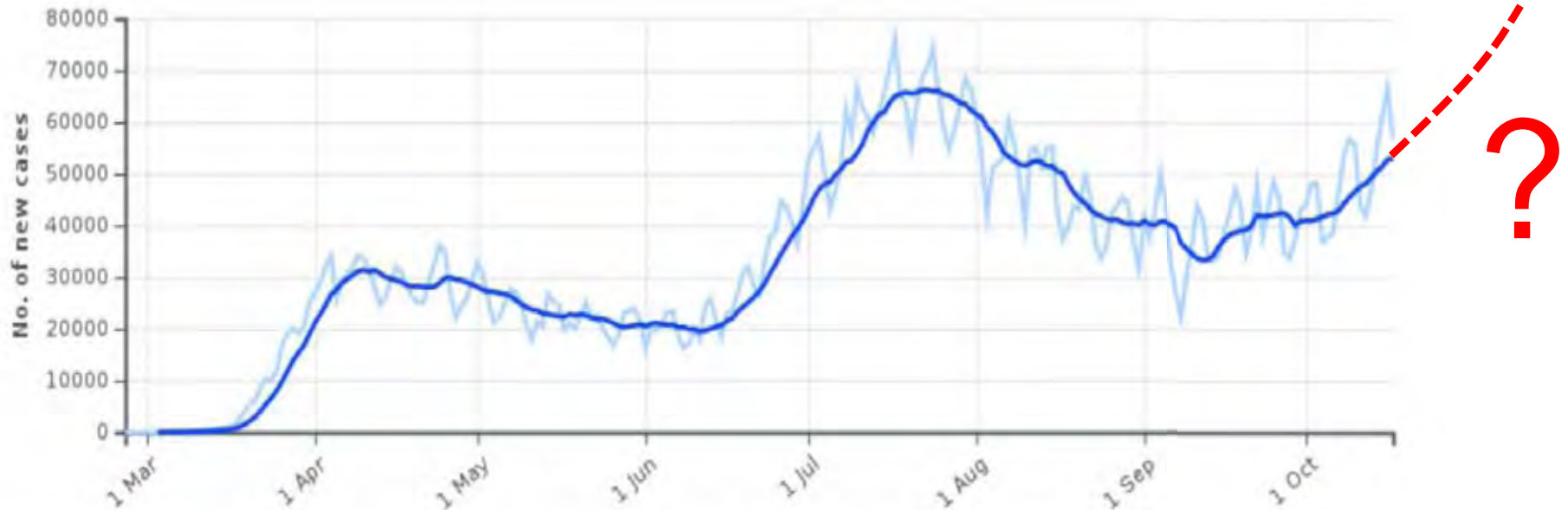
 Resources

[Healthcare](#) | [Residential](#) | [Multifamily](#) | [Commercial](#) | [Schools and Universities](#)

Epidemic

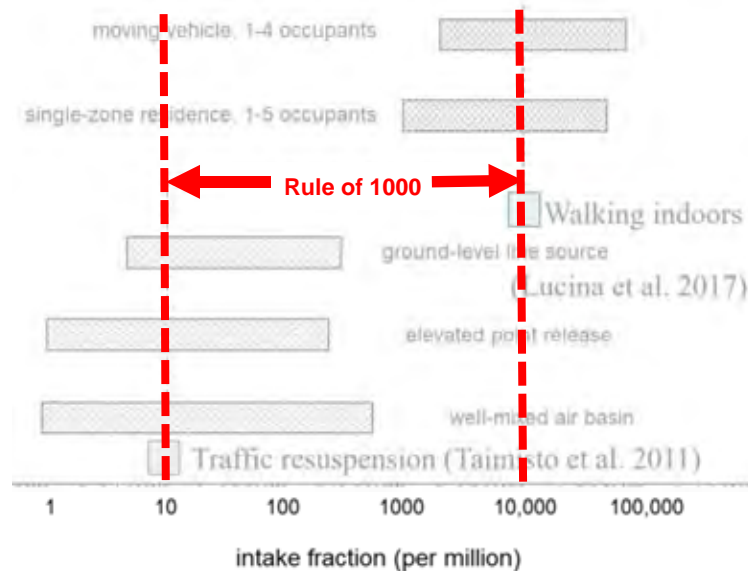


US NEW COVID CASES, 7 DAYS MOVING AVERAGE

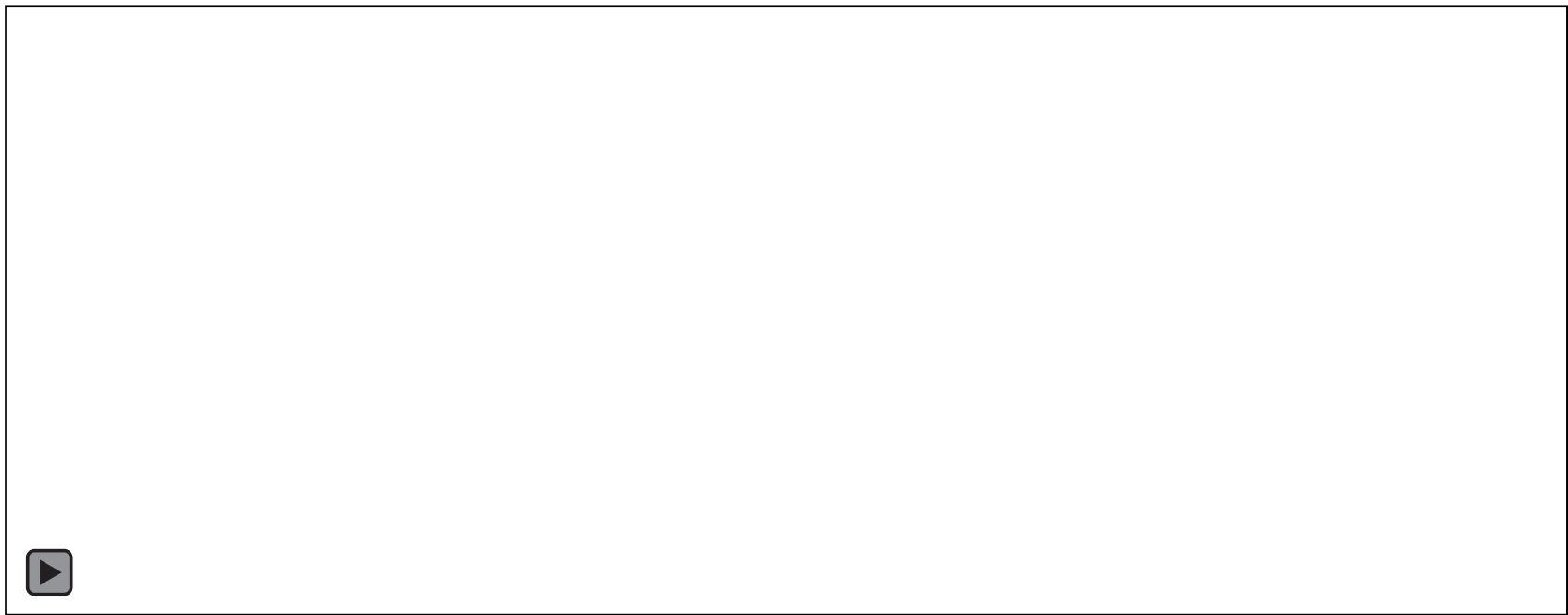


RULE OF "1000":

A POLLUTANT RELEASED INDOOR IS 1000 TIMES MORE LIKELY TO BE INHALED

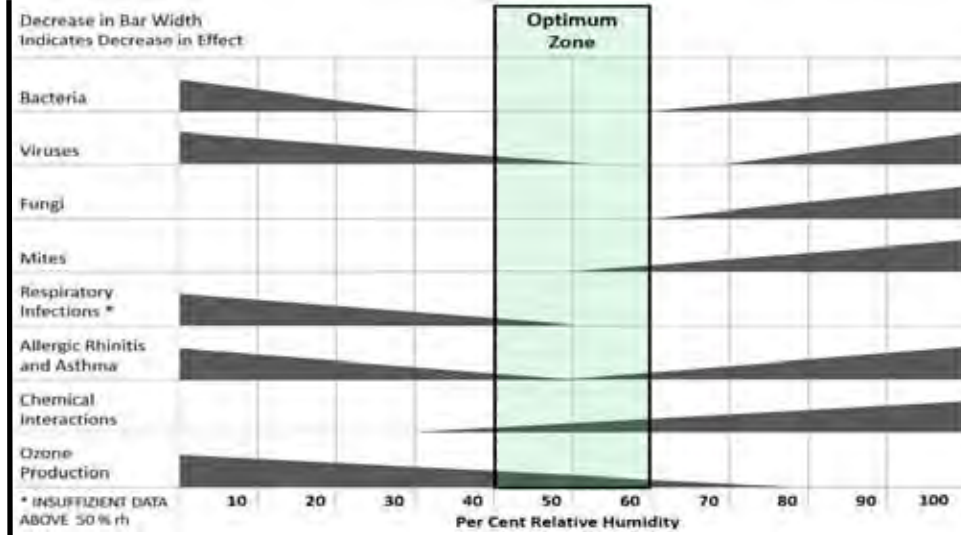


SUN VS. NO SUN



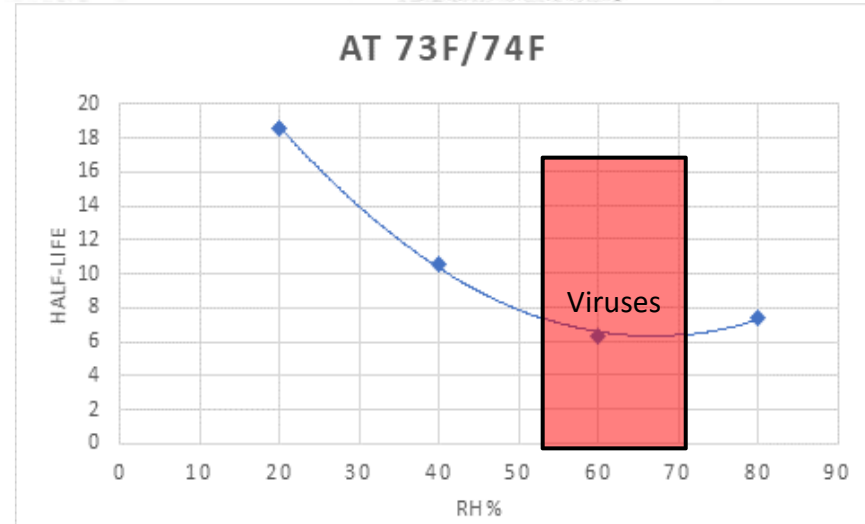
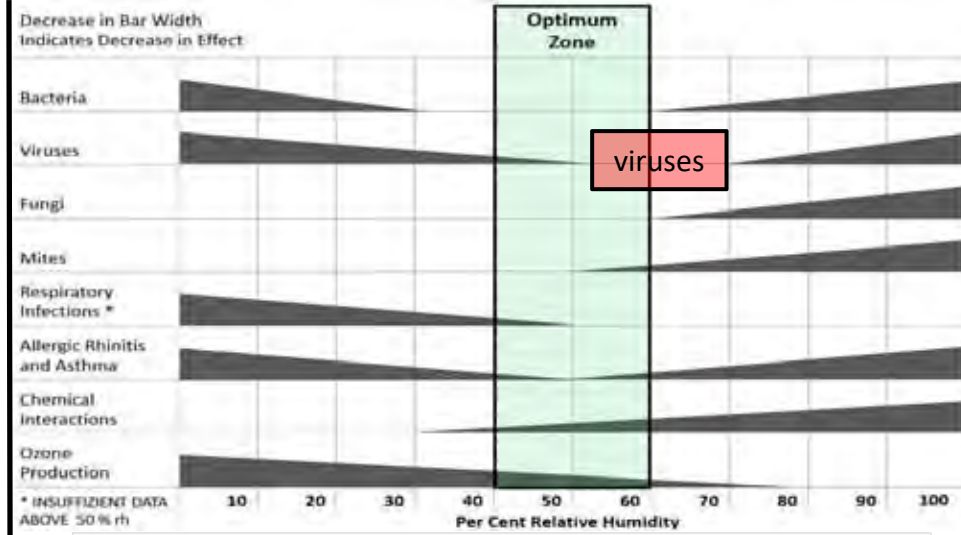
ENVIRONMENT

Relative Humidity 40-60%



ENVIRONMENT

Relative Humidity 40-60%



US TOTAL CONSTRUCTION SPENDING

U.S. Total Construction Spending Summary						
\$ in billions % growth vs prior yr	Year-to-date August 2020 \$		Forecast 2020		Forecast 2021	
Total Construction	928	4.2%	1400	2.5%	1361	-2.8%
Residential	386	7.2%	582	5.7%	585	0.6%
Nonresidential Buildings	309	-0.3%	460	-2.6%	416	-9.6%
Nonbuilding Infrastructure	233	5.8%	358	4.3%	360	0.5%
Educational	70.3	-0.7%	101.5	-3.7%	93.0	-8.4%
Healthcare	31.3	6.5%	47.2	3.5%	45.5	-3.5%
Amusement / Recreation	18.1	-9.6%	26.8	6.9%	21.3	-20.5%
Commercial / Retail	55.1	5.2%	81.1	0.9%	69.1	-14.8%
Lodging	20.0	-9.4%	29.2	-11.7%	21.0	-28.0%
Office	53.9	-3.1%	80.5	-5.1%	76.7	-4.8%
Manufacturing	49.1	-6.3%	75.7	-5.8%	72.4	-4.4%
Other Nonres Bldgs	11.4	29.0%	17.7	25.0%	16.9	-5.0%
Power	29.9	12.1%	120.6	5.9%	105.2	-11.8%
Highway / Bridge / Street	65.6	1.7%	102.3	4.0%	106.9	-4.5%
Transportation / Air / Rail	37.2	0.2%	57.7	1.0%	68.0	17.7%
Sewer / Water / Conservation	35.8	8.2%	54.5	4.8%	57.3	5.1%
Communication	14.7	-2.8%	22.6	1.2%	22.2	-1.9%

Forecast includes U.S. Census August 2020 year-to-date spending as of 10-1-20.
Forecast includes Dodge construction starts Midyear Update 8-4-20 + Sept.

enr@enr.com



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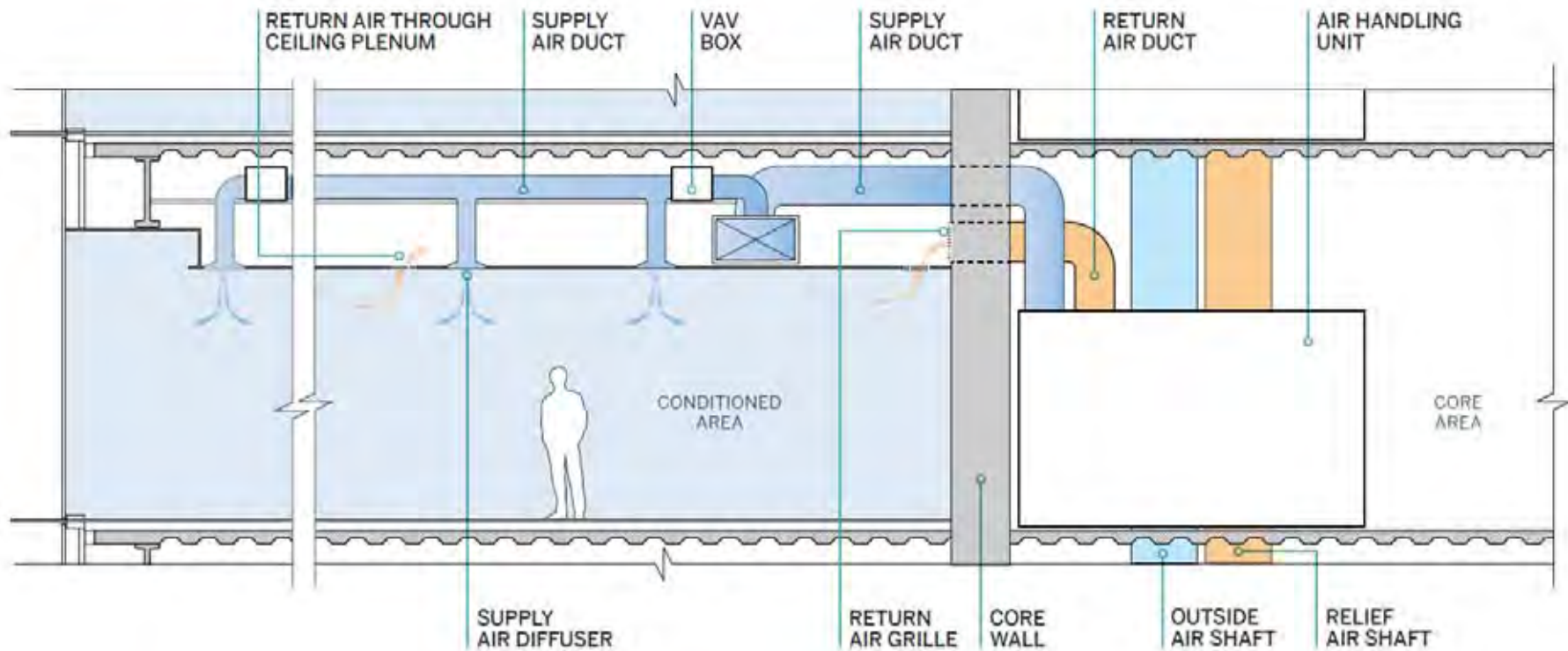
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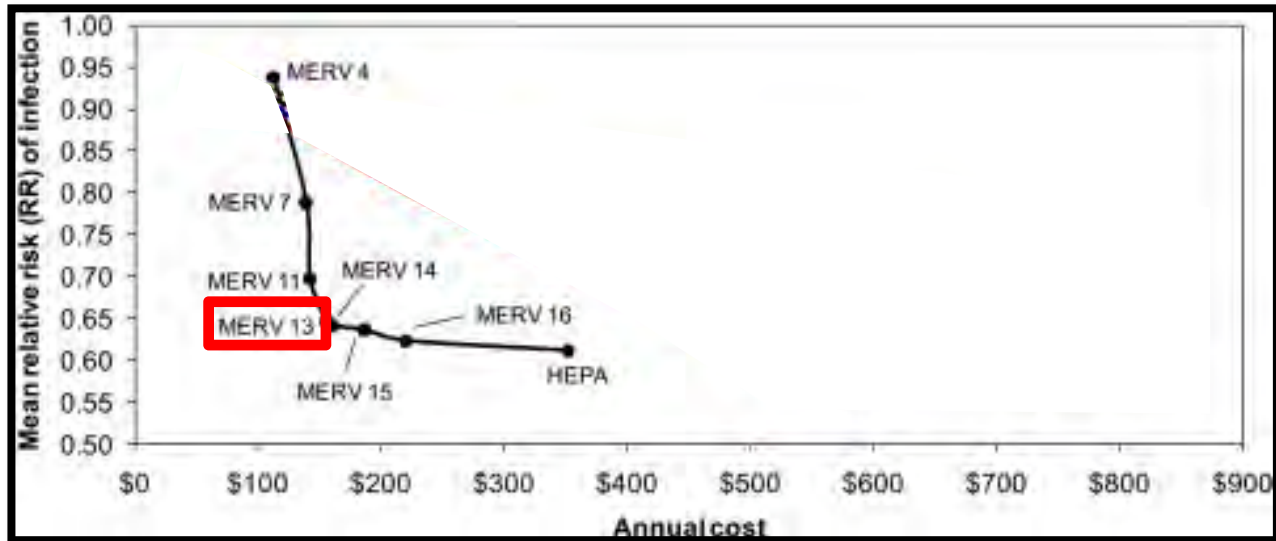
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wdrarenski.com

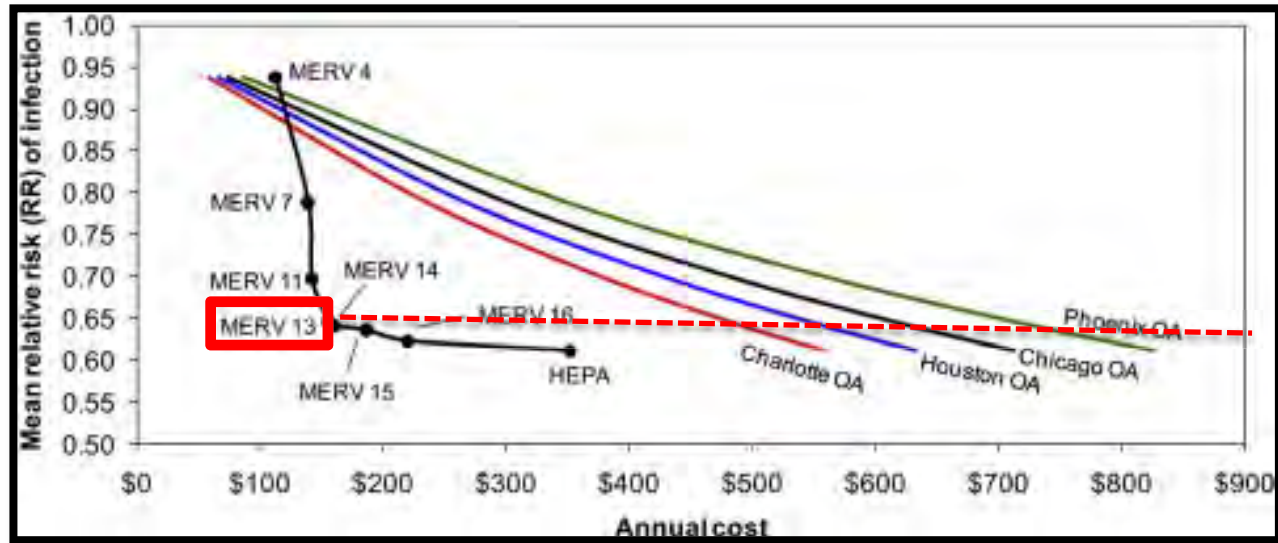
VAV



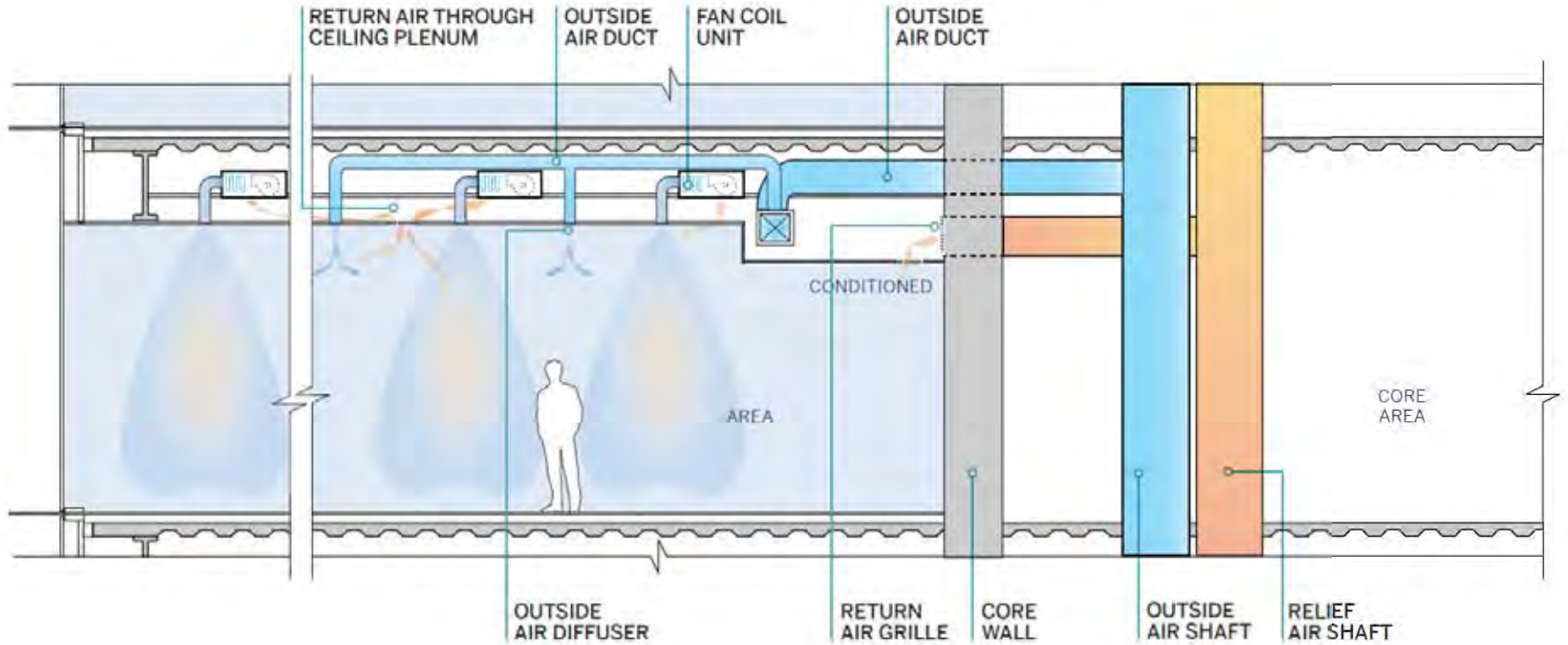
100% OUTSIDE AIR VERSUS FILTRATION



100% OUTSIDE AIR VERSUS FILTRATION



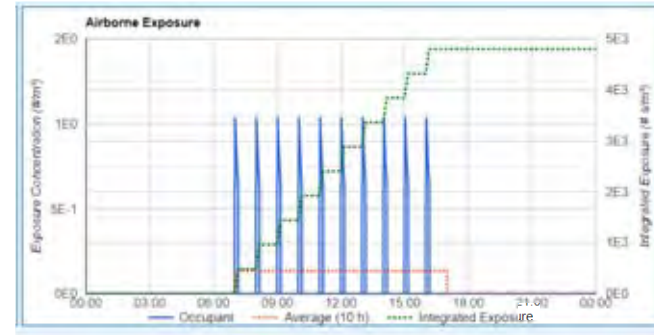
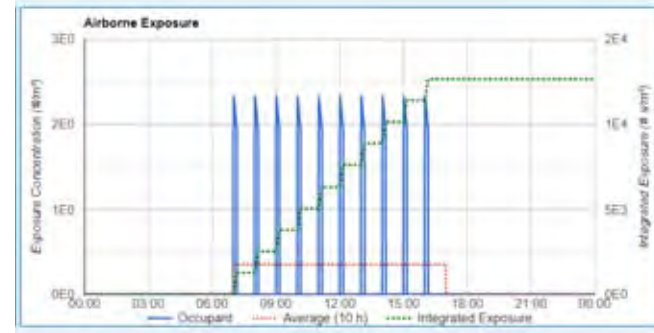
DOAS – FAN COIL OR VRF: PUT THE HIGHEST GRADE FILTER POSSIBLE



DOAS VS VAV - AEROSOL

DOAS
(No Filter) Integrated Exposure: 1.0E4 (#s/M³)
 Exposure Concentration: 2.3E0 (#s/M³)

VAV with MERV 13
(Same OA as DOAS) **48% OF DOAS**
 Integrated Exposure: 4.8E3 (#s/M³)
 Exposure Concentration: 1.1E0 (#s/M³)
 47% OF DOAS



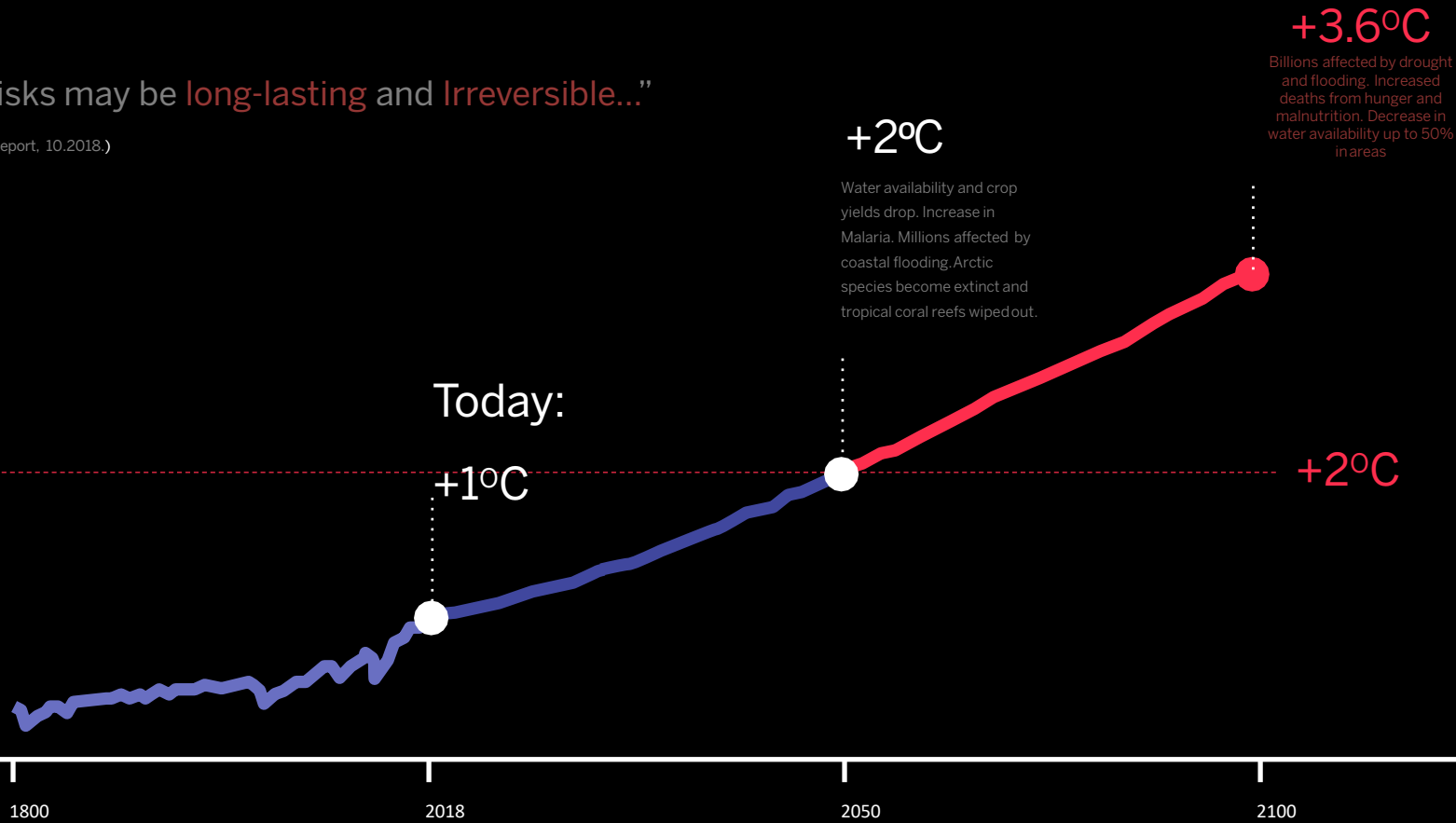
Election





“...risks may be long-lasting and Irreversible...”

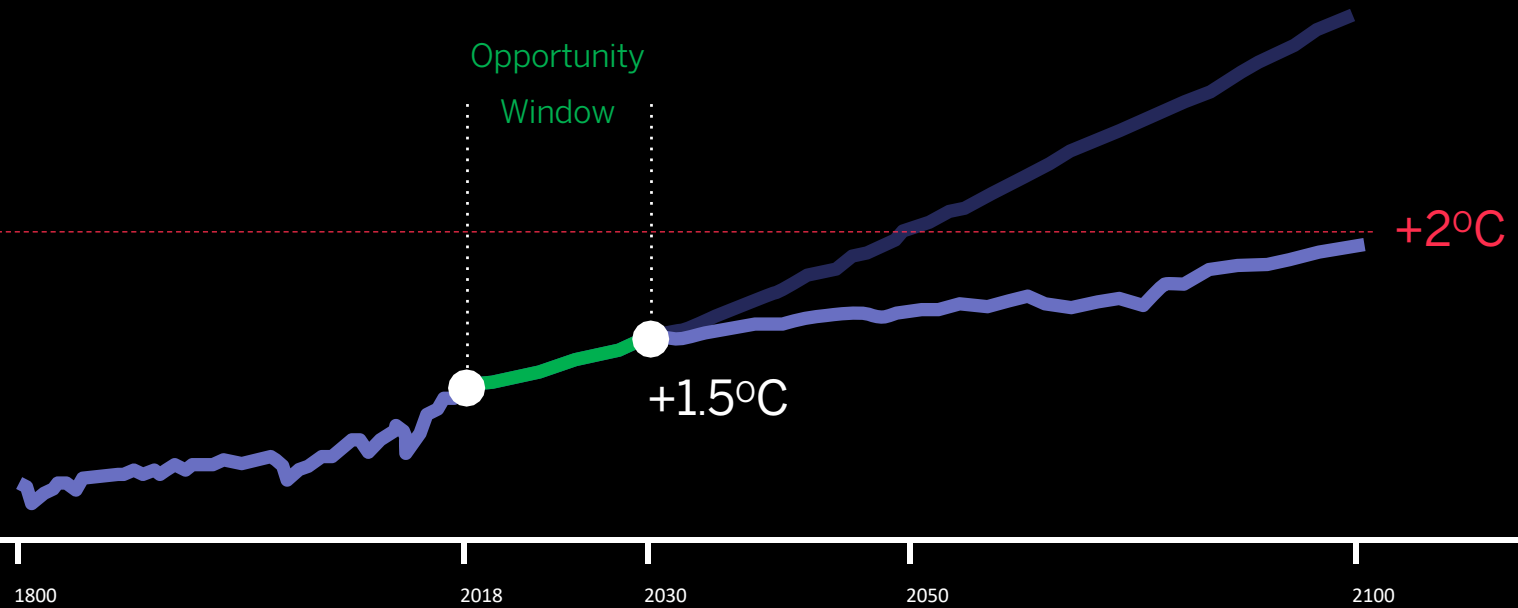
(UN IPCC Report, 10.2018.)






“...Limiting global warming would require rapid and far-reaching transitions...”

(UN IPCC Report, 10.2018.)



A stack of several hands, likely belonging to business professionals, is shown in a dark, moody setting. The hands are stacked on top of each other, with fingers slightly curled, suggesting a gesture of unity or support. The lighting is low, highlighting the texture of the skin and the fabric of the sleeves, which appear to be business suits. The overall tone is serious and focused.

It is no longer a choice – It is about delivering a

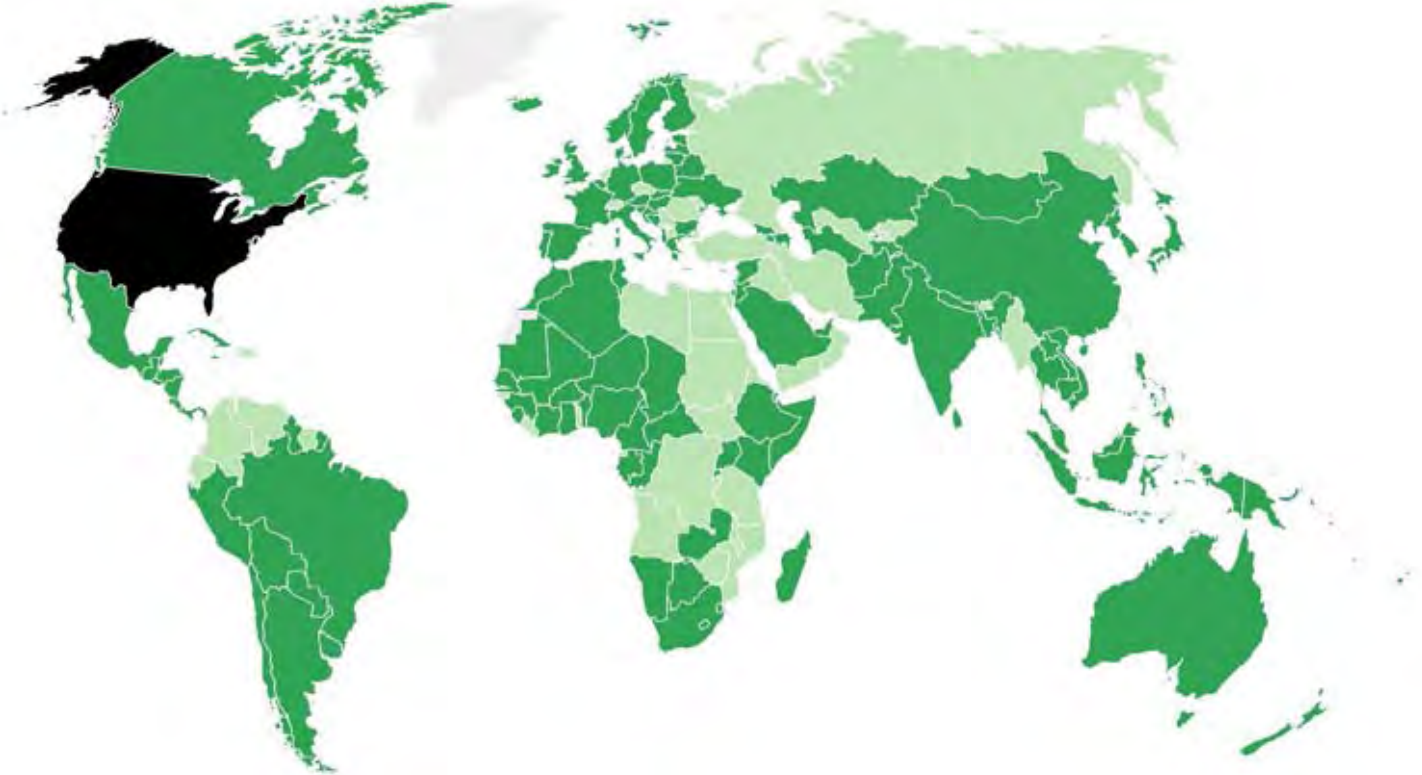
commitment



Nations Unies
Conférence sur les Changements Climatiques 2015
Paris, France

Nations Unies
Conférence sur les Changements Climatiques 2015
Paris, France

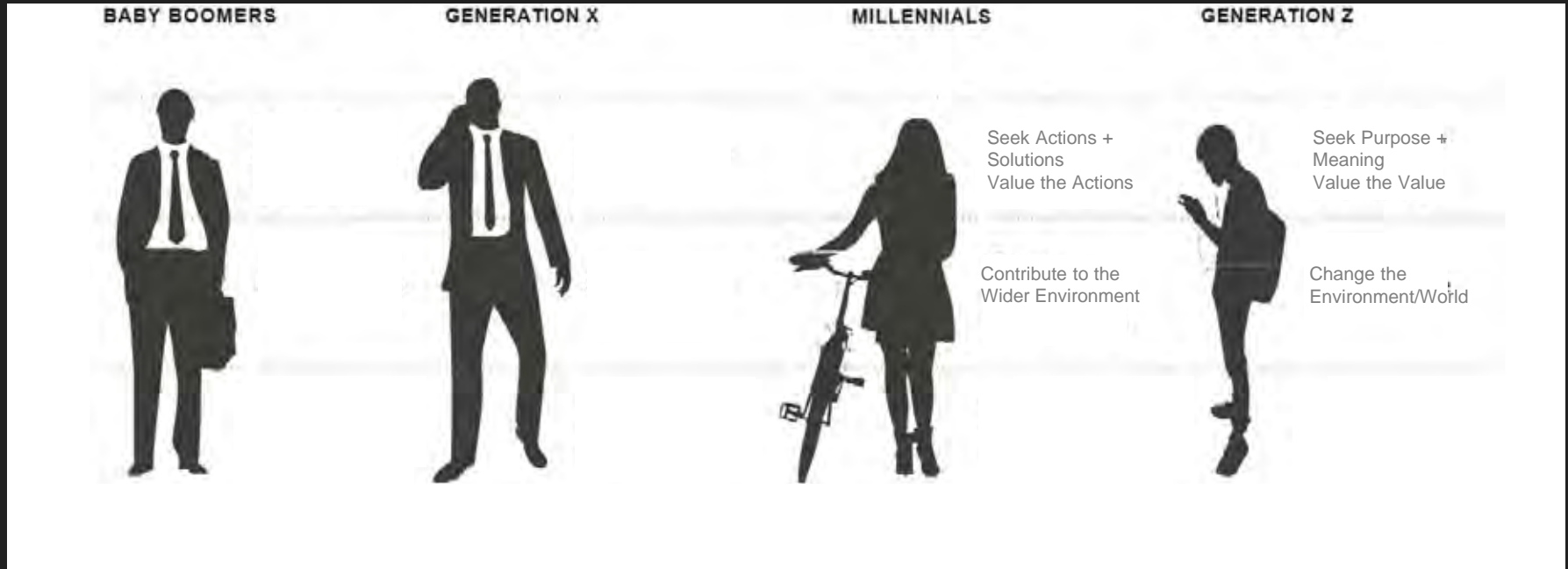
PARIS AGREEMENT SIGNATOIRES AND JOINED COUNTRIES



■ Withdrawing from Paris Agreement ■ Signed ■ Joined ■ No data



THE NEXT GENERATION IS RAISING THE BAR RAISING AWARENESS, SHIFTING PRIORITIES



ASSOCIATIONS ARE RAISING THE BAR DESIGNERS RESPONSIBILITY

“...**concern for others and for the environment**, are the foundations of the Royal Institute’s three principles of professional conduct...Members should be **aware of the environmental impact of their work.**”

“...Members shall conform to existing laws regulations and codes...” and “...**at all times consider the health, safety and welfare of the public.**”

“... advise clients and employers of their **obligations to the environment** ...; a built environment that equitably **supports human health and well-being** and is **resistant to climate change...**”

2005

2011

2013

2016

2018

RIBA 
Royal Institute of
British Architects

 NCSEA
National Council of Structural Engineers Associations

I | I | D | A
INTERNATIONAL
INTERIOR DESIGN
ASSOCIATION

 American Institute
of Certified Planners

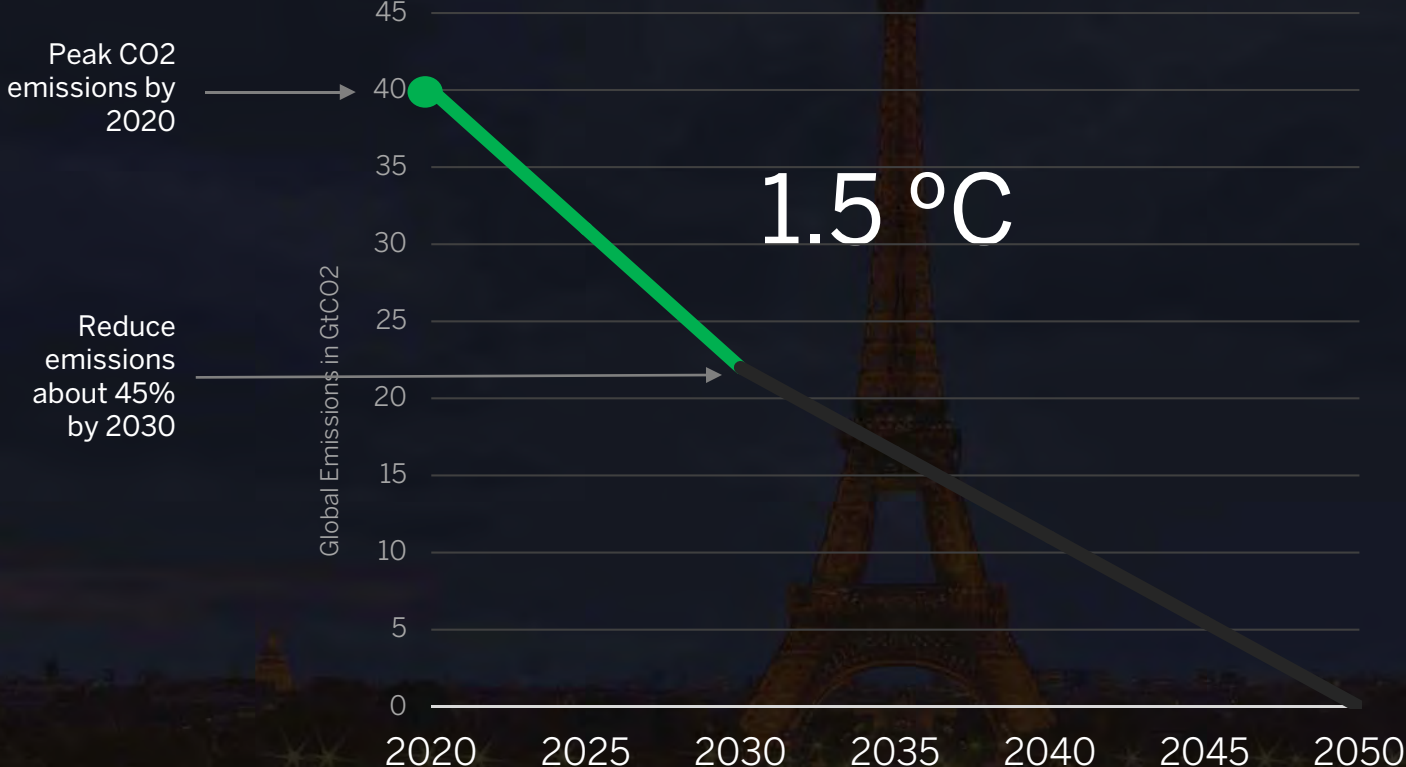
 The American
Institute
of Architects

UN IPCC Road Map to 2050 Zero Carbon Economy

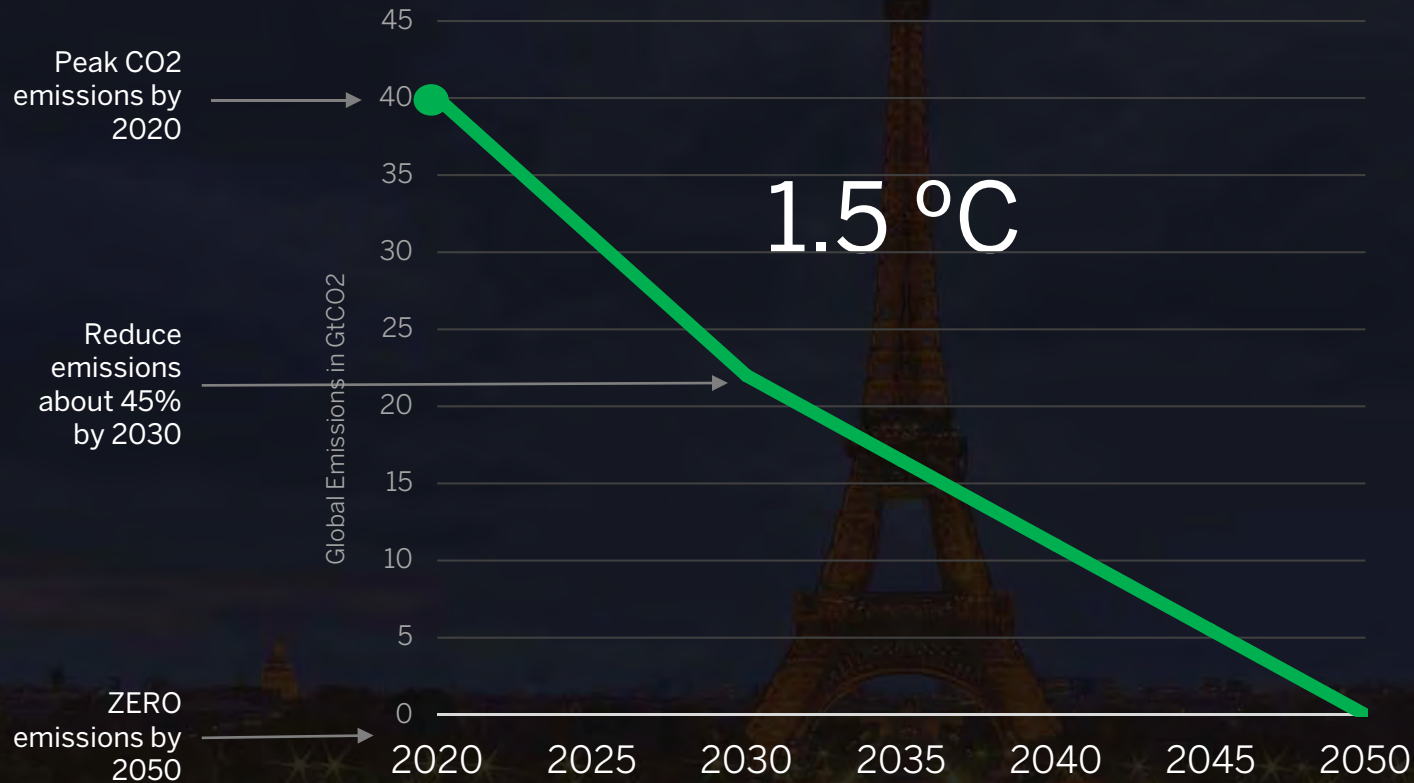
Peak CO2 emissions by 2020



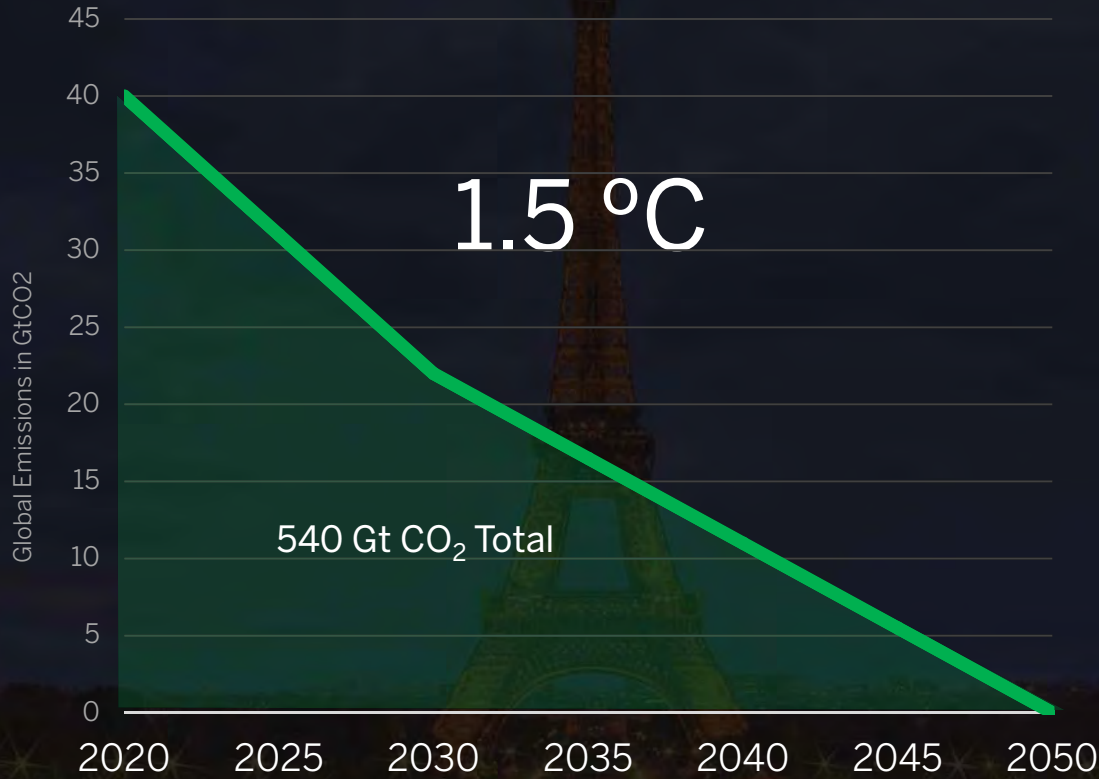
UN IPCC Road Map to 2050 Zero Carbon Economy



UN IPCC Road Map to 2050 Zero Carbon Economy



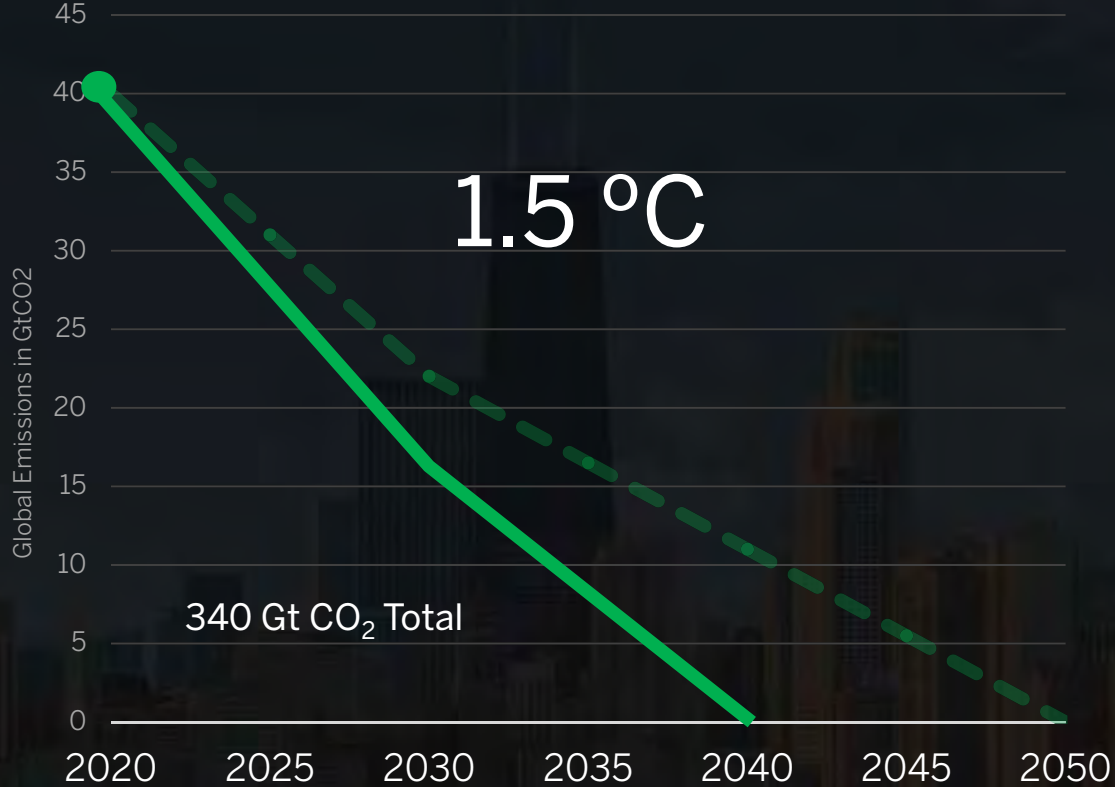
Road Map to 2050 Zero Carbon Economy



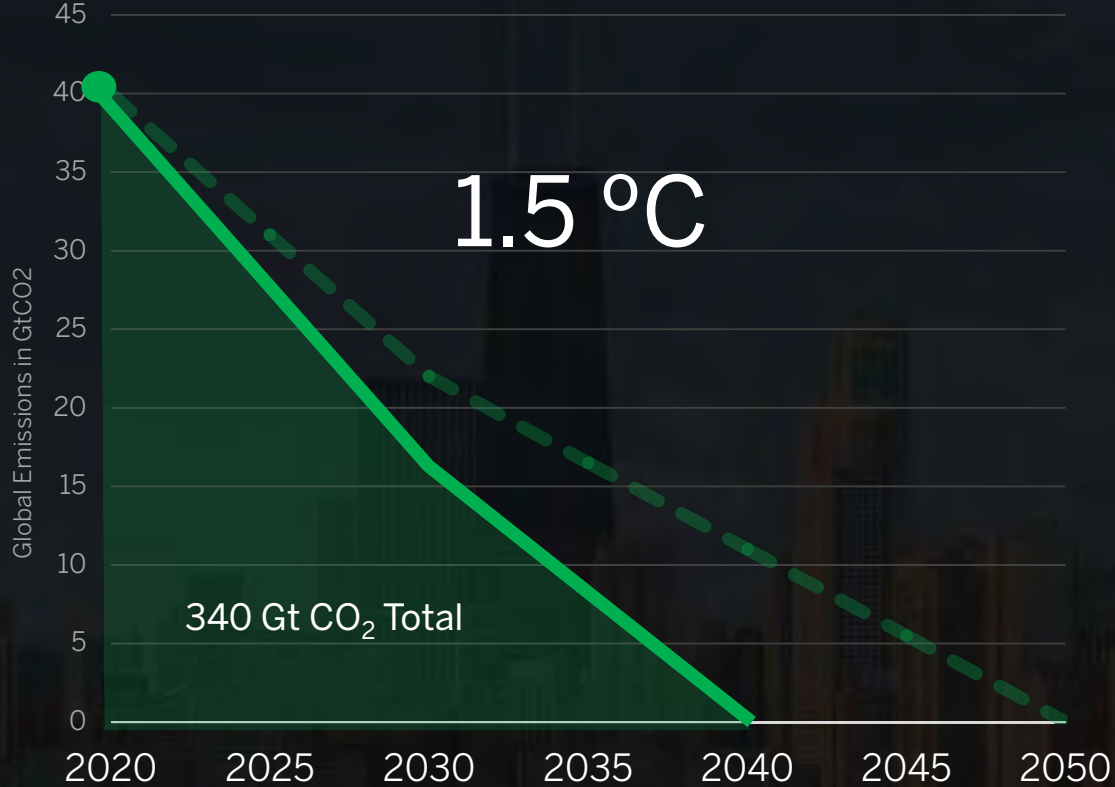
Road Map to 2050 Zero Carbon Economy

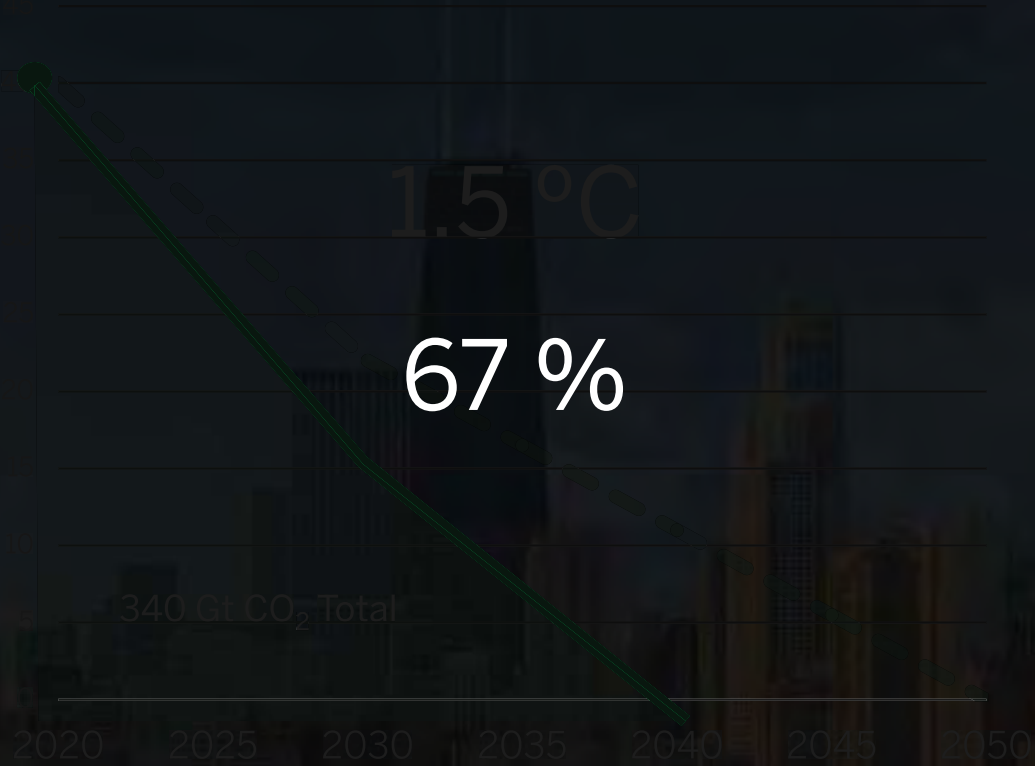


AIA LFRT Summit Road Map to 2040



AIA LFRT Summit Road Map to 2040







**NYC's
Groundbreaking
Emissions Law**

Local Law 97 (LL97) sets carbon emissions caps on buildings over 25,000 sq. ft.

[LEARN MORE »](#)

NYC's Climate Mobilization Act

How the law's increasingly stringent standards could affect the same building in coming years

2024
No fines



2030
Fines of \$1.5 million annually

 **Great Forest**
Sustainable Energy Solutions

2019 – Building Code Committed

An aerial night view of a city street, showing illuminated buildings, streets, and traffic. The image is split vertically by a diagonal white line. The left side is a faded, semi-transparent version of the same scene, while the right side is the original, vibrant night view.

ZERO CODE TM

Building projects in New Jersey will now have to account for climate change

By Evan Simko-Bednarski, CNN
Updated 10:25 PM ET, Thu January 30, 2020



Post-storm flood water inundate a street in Seaside Park, New Jersey.

Electrification to Post Carbon World





COBS

THE BORGERS ALLEY

MEP EMBODIED CARBON LETTER

Date: January 14, 2025
Re: Electrification product needs for the MEP industry.

Dear MEP Equipment Manufacturer,

As the need to decarbonize the building industry becomes more crucial, we as MEP engineers are consistently challenged with the need to design efficient, effective building systems that don't use fossil fuels.

This is being specifically driven by a number of local initiatives and legislations, already passed or in development including but not limited to Local Law 97 (of 2019) in NYC, the ban on Natural gas in Berkeley, CA, the University of California Office of the President Carbon Neutrality Initiative, the "Clean Energy D.C. Omnibus Act of 2018," net zero building codes in Massachusetts, local gas moratoriums and others. More importantly, it is driven by the ultimate goal of net zero carbon and the reality that there is no way to reduce carbon emissions to safe and sustainable levels if we continue to heat our buildings with fossil fuels.

The Sustainable MEP Leaders group, organized by BuildingGreen, is a group of motivated individuals, representing many of the leading engineering firms in North America, including most of the signatories on this letter. Our teams include tens of thousands of MEP engineers practicing in the US market.

We need suitable equipment to address this growing need and we look forward to working with you to identify and meet this rapidly expanding market demand. We also need equipment that uses low-global-warming potential refrigerants. Finally, given the increasing attention on embodied carbon in buildings, we will be especially interested in products with environmental product declarations (EPDs).

We ask you to make it a priority to research, develop, market, and support the product types listed below. Please join us in the effort to support international climate goals and improve our industry together.

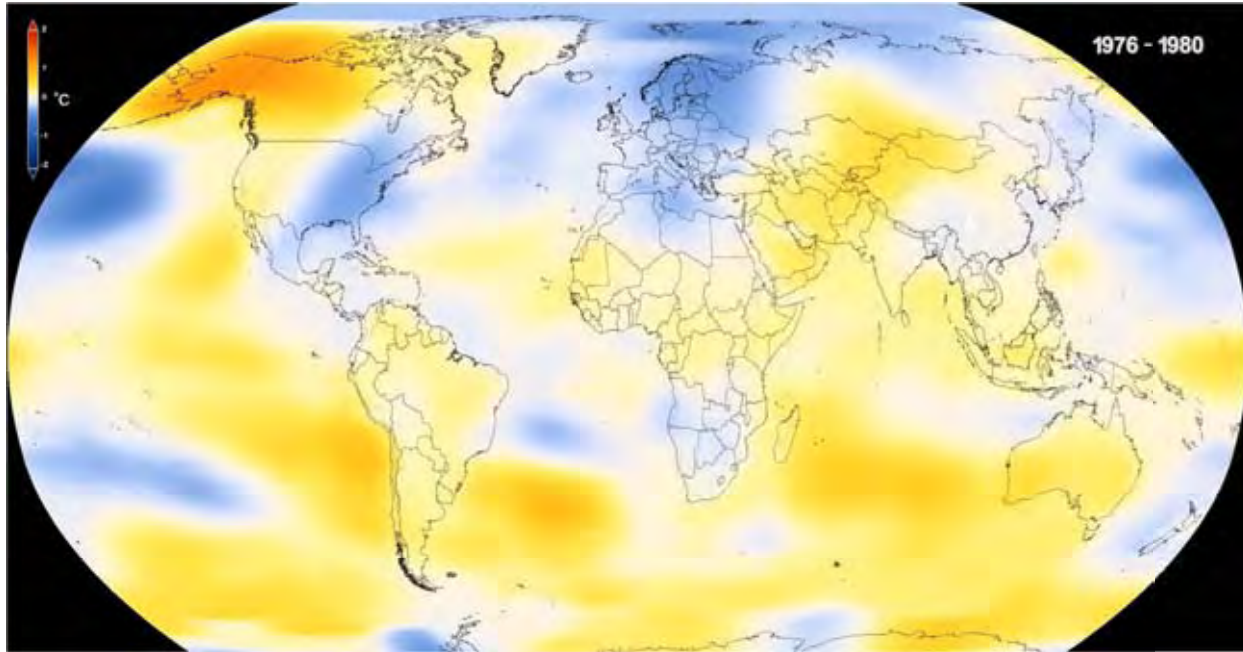
The list below represents many of the areas and elements of targeted product development we think crucial to the future success of decarbonized buildings. We're also encountering similar needs for process loads in many of the buildings we design, such as laboratories, hospitals, and commercial kitchens, but we have not itemized those needs here.

Heat Pump Solutions:

- All units tested and certified to operate at 0°F ambient without significant derating
- Increased compressor efficiency in heating mode at cold ambient temperatures (focus on equipment operation for both cooling and heating across OA temperature ranges)
- Development of products utilizing alternative refrigerants, such as HFO and CO₂, that have a lower global warming potential than traditional refrigerants, along with:
 - Low impact alternative refrigerants for existing equipment
 - Clear documentation on the carbon footprint of refrigerants
 - Decommissioning best practices
- Air-to-water heat pumps capable of producing warmer water at 0°F (HW supply targets):
 - Simultaneous cooling / heating machines (producing HW and CHW simultaneously through heat recovery operation)
 - Target warmer HW supply temperatures (100°F - 140°F or higher)
 - A full product line with heat pump sizes to include larger capacity systems, comparable to current water-cooled chillers and gas-fired boiler product sizes
- VRF systems:
 - Advancements in heating capacities at 0°F
 - Additional standard unit sizes and configurations, including both very large and very small units (for individual units in multifamily Passive House projects, for example)
 - Customizable units



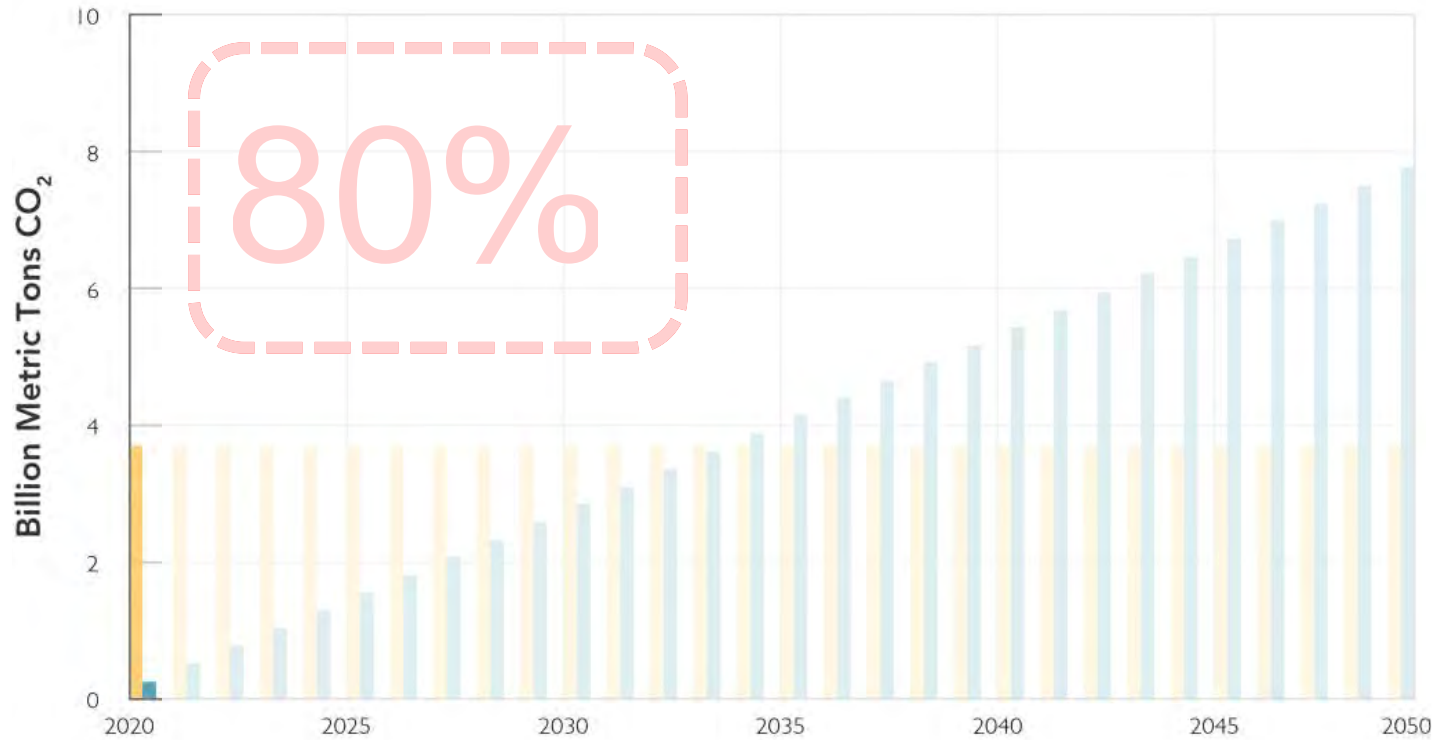
Emission



NIA

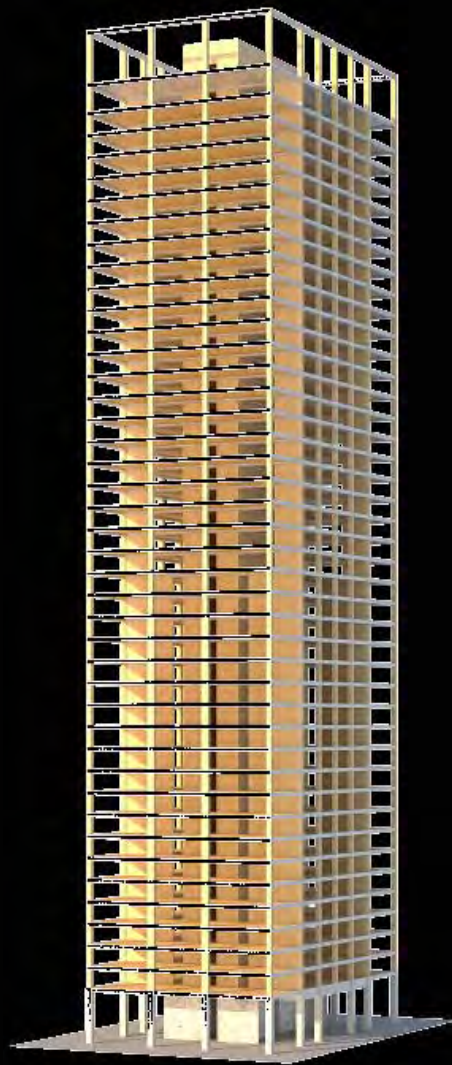
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Fall Summit 
EDUCATE | ENGAGE | ELEVATE / 2026



Low Embodied Carbon

60-75%
TIMBER TOWER REDUCING
EMBODIED CARBON
FOOTPRINT BY:





Long Beach Main Library



LONG BEACH MAIN LIBRARY | ADAPTATION OF PARKING GARAGE

CONCRETE: 70 CO₂eq PSF

TIMBER: 35 CO₂eq PSF

DEPARTMENT OF ENERGY AND EMBODIED CARBON



EC3

What About MEP ?



1. Tools and Analysis

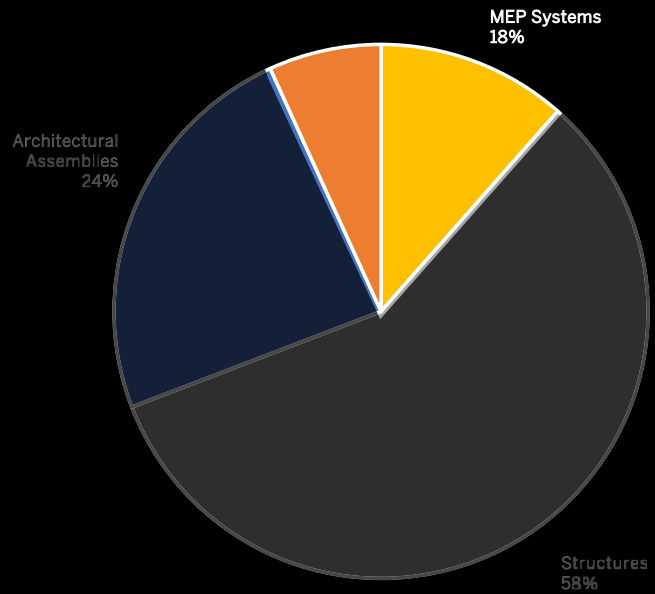


2. Benchmarking



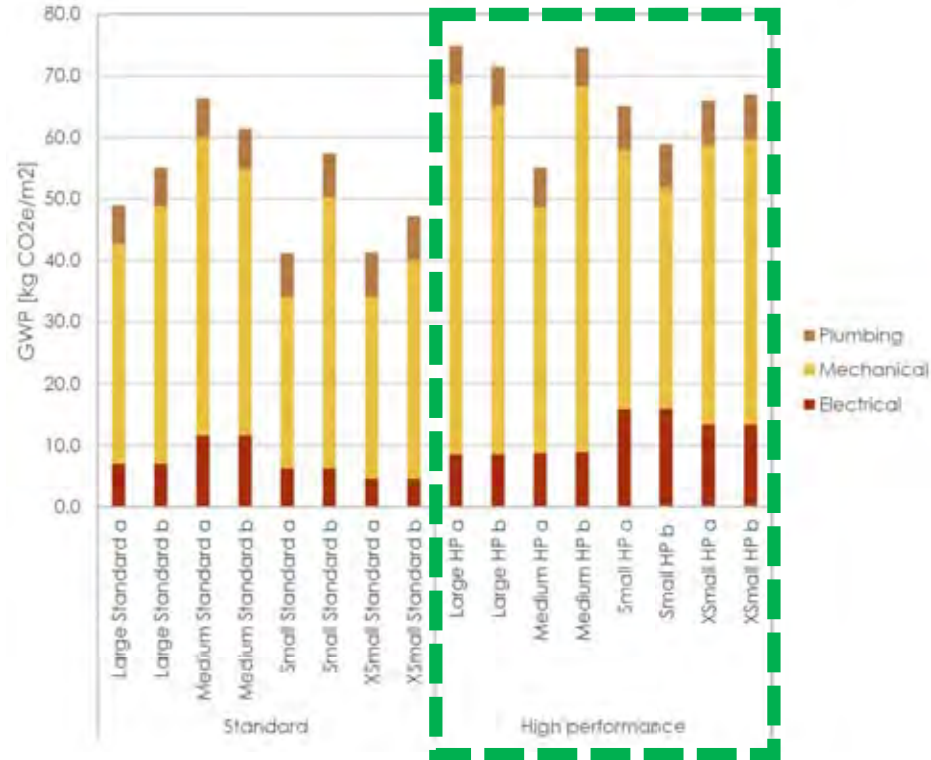
3. Targets

MEP EMBODIED CARBON



Total Embodied Carbon
174 lb CO₂e/sf

MEP EMBODIED CARBON - OFFICE

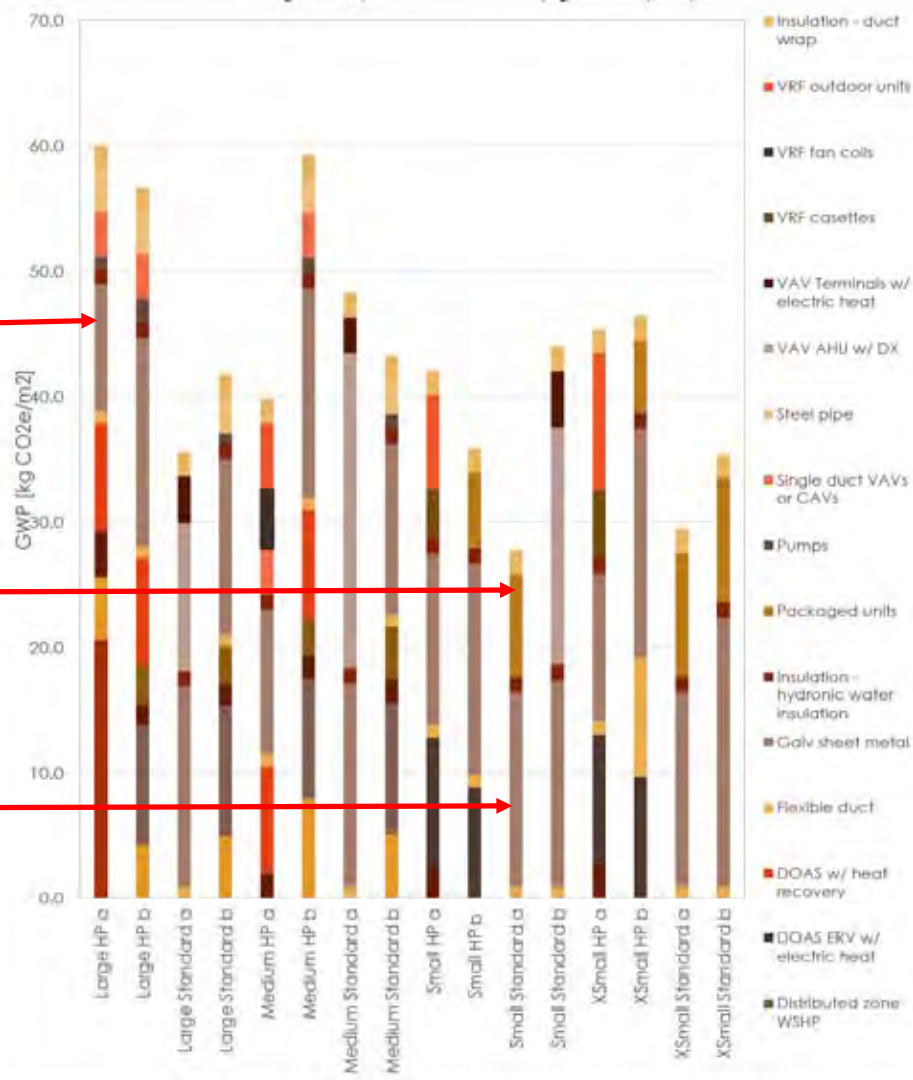


MEP EMBODIED CARBON - OFFICE

Chiller, Boilers, AHU, Chilled Beams

Roof Top Package Unit

Galvanized Steel

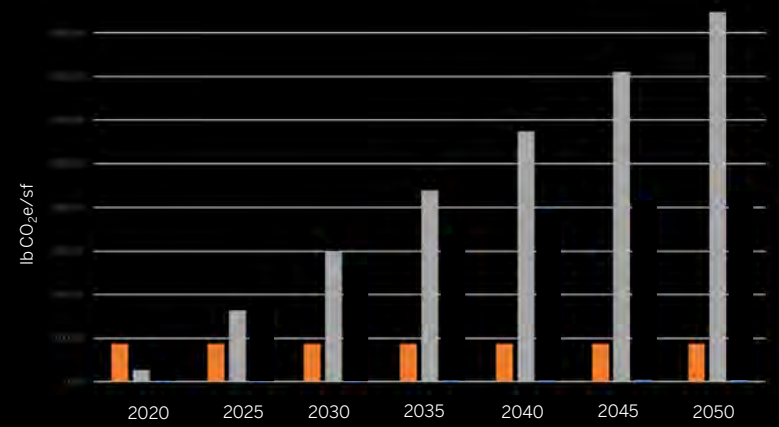


MEP EMBODIED CARBON AND OPERATING CARBON



- Embodied Carbon
- Operational Carbon: Dirty Grid
- Operational Carbon: Clean Grid

Embodied vs. Operational Carbon: Building Lifetime



MEP EMBODIED CARBON LETTER

Very truly yours,

The following leading MEP design firms:



Date: September 8, 2020

Re: Embodied carbon [information needs](#) for the MEP industry

Dear MEP Equipment Manufacturer,

As the need to decarbonize the building industry becomes more crucial, we as MEP engineers are frequently challenged with the need to design efficient, effective building systems that reduce the total carbon footprint of new construction and renovation projects. Embodied carbon as part of the life cycle carbon study is already included in selected UK MEP firms in their "[Climate and Biodiversity Declaration](#)".

Our industry has been strongly focused on energy reduction through the past 20+ years. More recently, the focus has shifted from energy to carbon reduction in operations. This has been primarily achieved through energy reduction, utility source selection, and integration of renewable energy. Having achieved good progress in this area, our focus is now moving to the embodied carbon associated with construction activity. Simply put, embodied carbon looks at the carbon impacts associated with extracting, manufacturing, and transporting materials to the jobsite. For a more detailed explanation see, <https://www.buildinggreen.com/feature/urgency-embodied-carbon-and-what-you-are-about>.

As shown in the graphic below, as operational carbon reduces, embodied carbon becomes a larger piece of the carbon footprint and begs the attention of the design community. We are making good progress defining and taking action on the embodied carbon associated with the building structure. The purpose of this letter is to advance the conversation on embodied carbon associated with MEP systems.

Operating vs Embodied Carbon



The Sustainable MEP Leaders group, organized by [BuildingGreen](#), is a group of motivated individuals, representing many of the leading engineering firms in North America, including most of the signatories on this letter. Our teams include tens of thousands of MEP engineers practicing in the US market.

To advance this effort, we need to improve understanding and data availability of the embodied carbon associated with MEP equipment. See breakout in the graph below. While the long-term effort will include all meaningful carbon sources within MEP equipment; this initial focus targets [refrigerant-based equipment and large, non-refrigerant-based equipment](#).

Previous research indicates that refrigerant likely the largest source of carbon within the equipment from the perspective of initial charge, leakage, re-charge, and replacement throughout the life of the building. [Refrigerant based equipment is also large, non-refrigerant-based equipment](#) is seen to have a high volume of parts and materials, is sourced from numerous locations, is assembled and then shipped to the jobsite. This often results in a significant carbon footprint.