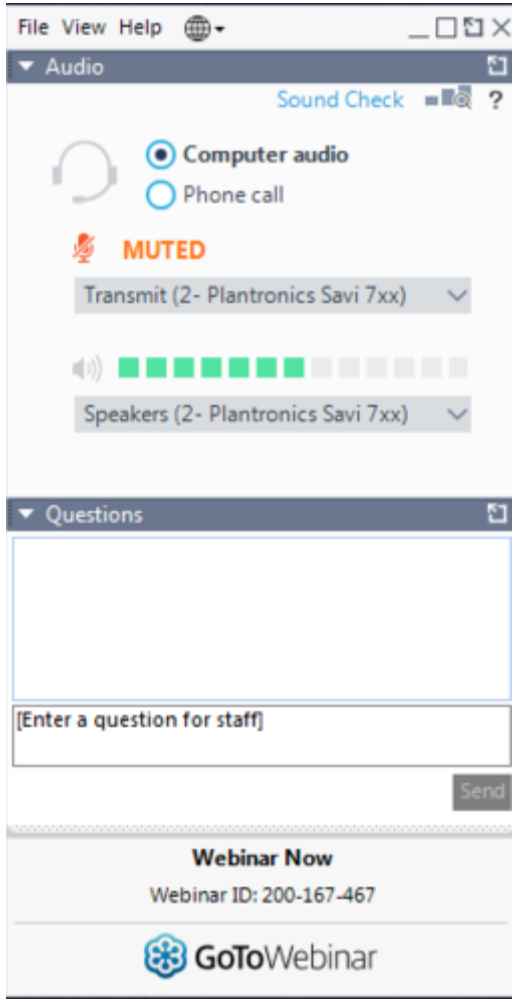
To Ask a Question



CDC

Guidance for Reopening Buildings After Prolonged Shutdown or Reduced Operation

Guidelines for Maintaining a Healthy Work Environment

ASHRAE EPIDEMIC TASK FORCE

Commercial COVID-19 Guidance

Agenda

- What ASHRAE and the CDC are recommending
- How ventilation systems work in commercial buildings
- The science behind the COVID-19 ventilation guidance
- How long will we have to follow new recommendations?
- How to follow guidelines
- Field example: HOM Furniture
- What ventilation data looks like in a BAS
- Implications for utility costs
- Q&A

CDC: Maintaining a Healthy Work Environment

As states start to reopen businesses, the Centers for Disease Control and Prevention currently recommends increasing ventilation rates and the percentage of outdoor air (OA) indoors.

- Keep systems running longer hours, 24/7 if possible, to enhance air exchange.
- Increase outdoor air ventilation, using caution in highly polluted areas.
- Disable demand-controlled ventilation (DCV) – a CO_2-based outside air sequence
- Open outdoor air dampers as high as 100 percent to reduce or eliminate recirculation.
- Improve central air filtration to the MERV-13 or highest compatible with the filter rack. Seal edges of the filter to limit bypass.

CDC: Reopening After Prolonged Shutdown

In addition to guidance for increasing ventilation while occupied, the CDC has issued guidance for re-opening buildings after a prolonged shutdown. The portion of this guidance pertaining to HVAC addresses mold awareness, monitoring, and remediation. There is additional guidance for plumbing systems not covered in this Webcast.

- During the shutdown, keep humidity levels as low as possible, not exceeding 50%.
- Before re-opening, conduct a mold assessment by trained professionals and remediate as needed.
- If HVAC system has not been active for a prolonged period (can be as short as a few days), flush the air for 2-3 days before occupancy with outside air at the highest level that can maintain desired temperatures.

ASHRAE: Reopening Guidance and Building Readiness

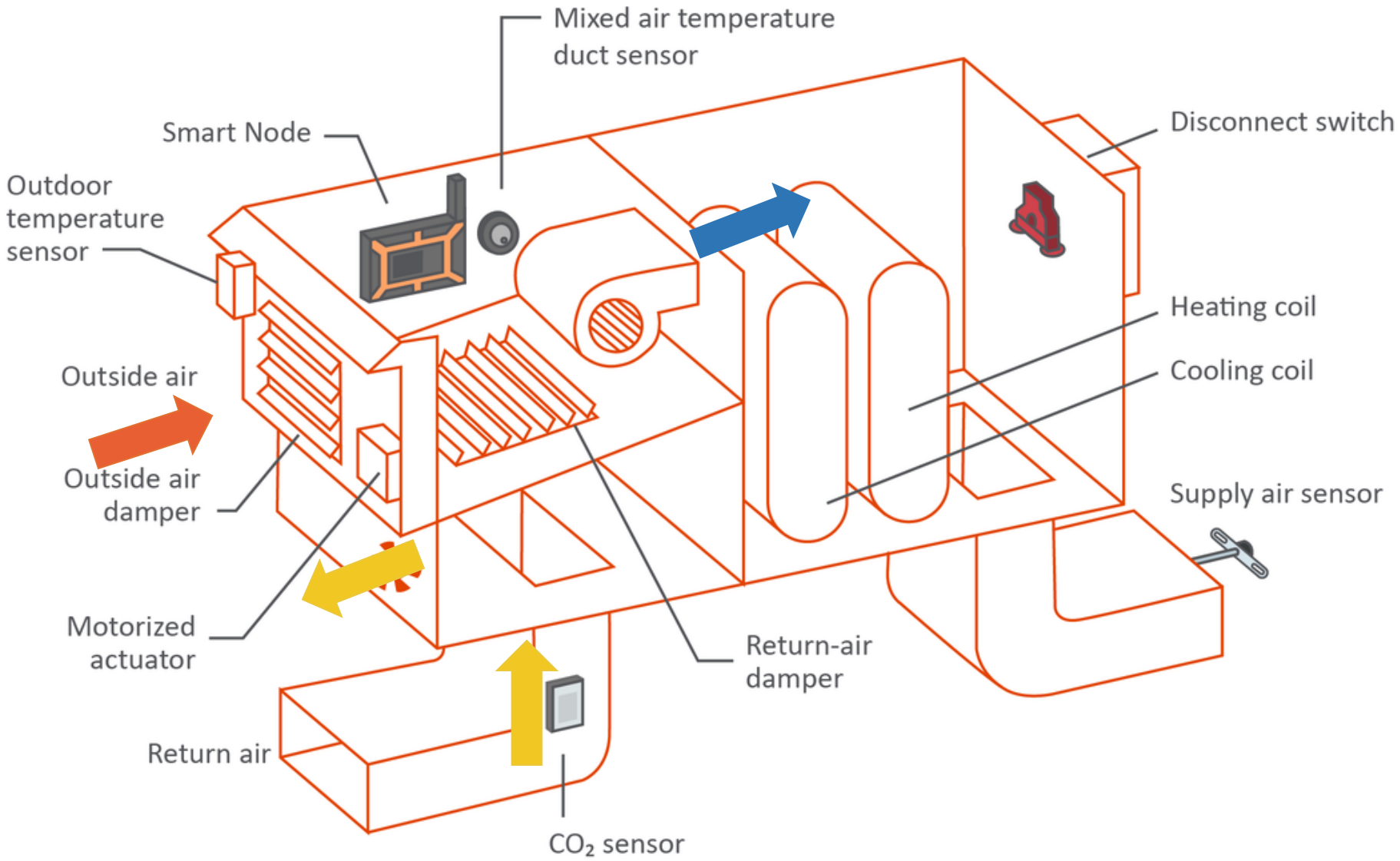
ASHRAE warns that “transmission of SARS-CoV-2 through the air is sufficiently likely that airborne exposure to the virus should be controlled. Changes to building operations, including the operation of heating, ventilating, and air-conditioning systems, can reduce airborne exposures..“ ASHRAE Commercial Building COVID-19 Guidance is given at their Web site:

ASHRAE > COVID-19 > Buildings > Commercial

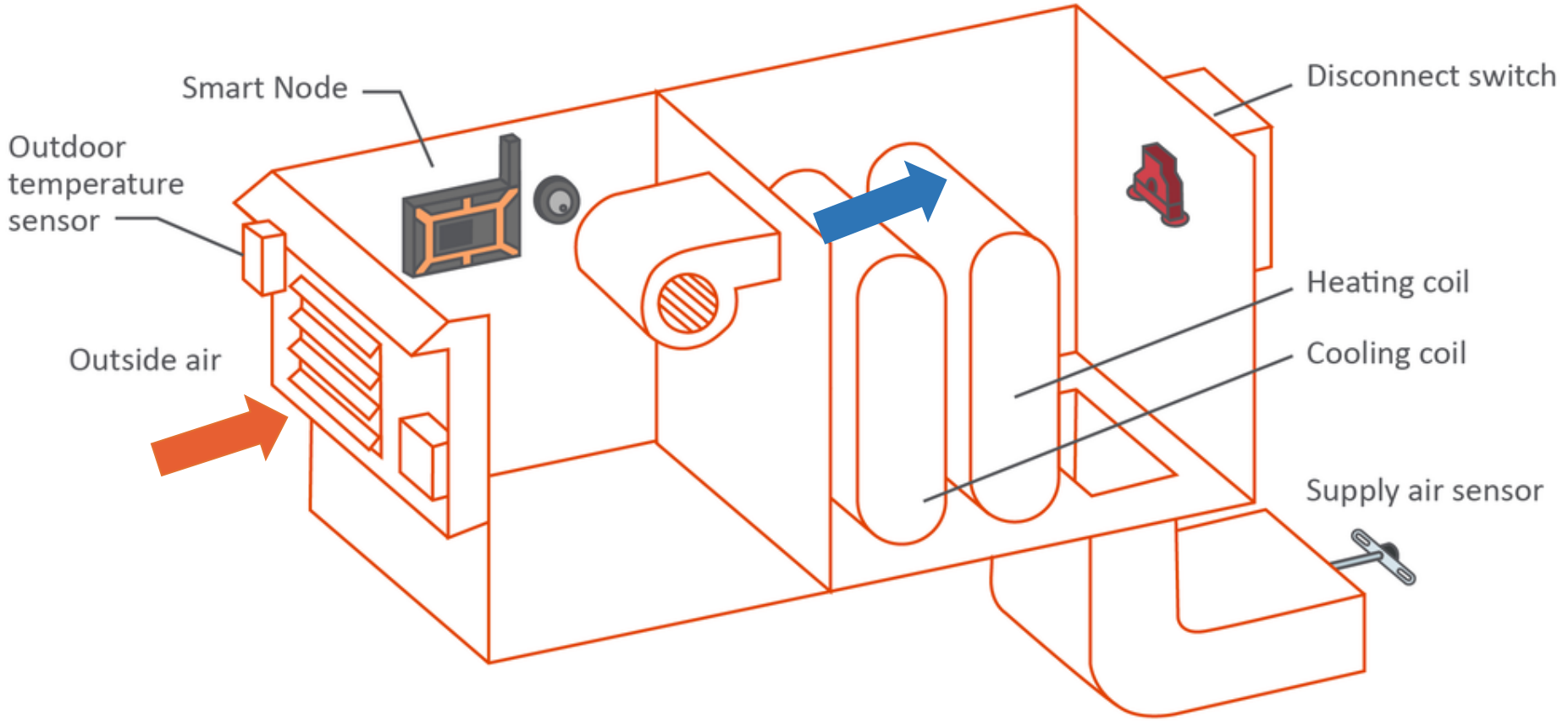
- Flush the air in a building for two full hours before and after occupancy.
- Open Outside Air (OA) to the maximum possible while maintaining acceptable indoor conditions
- Disable Demand Control Ventilation
- VAV systems: Increase discharge air temperature to max to encourage open VAV terminal unit dampers

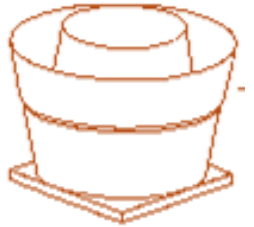
HOW VENTILATION SYSTEMS WORK IN COMMERCIAL BUILDINGS

Packaged Rooftop Units and Air Handlers



Dedicated Outside Air Systems (DOAS)





Exhaust fan

Q&A

SCIENCE: VENTILATION AND COVID-19

Contact Tracing

Resources for conducting contact tracing to stop the spread of COVID-19.

Protect Yourself While Shopping

Cover your mouth and nose with a cloth face covering when you have to go out in public.

Limit Visits to the Pharmacy

Plan to order and pick up all your prescriptions at the same time.

CDC Examination of Outbreak in South Korean Call Center

This example illustrates why the built environment can pose a considerable risk.

- One infected employee managed to infect 94 other people on a single floor of this call center.
- "Despite considerable interaction between workers on different floors of building X in the elevators and lobby, spread of COVID-19 was limited almost exclusively to the 11th floor, which indicates that the duration of interaction (or contact) was likely the main facilitator for further spreading of COVID-19."

Figure 2

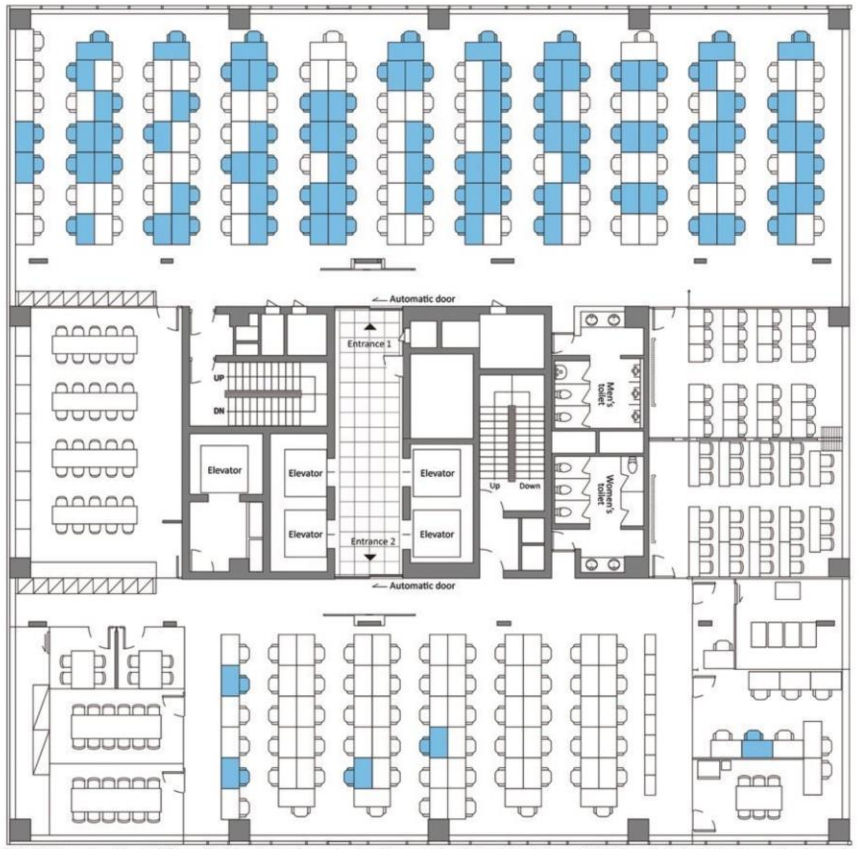


Figure 2. Floor plan of the 11th floor of building X, site of a coronavirus disease outbreak, Seoul, South Korea, 2020. Blue coloring indicates the seating places of persons with confirmed cases.

Graphic source: CDC

Viral Load

Since duration of interaction was likely the main facilitator of spreading, there is a measure of “viral load” or the concentration of virus particles per cubic foot of air.

- Reducing the viral load reduces the number of particles a person is exposed to in a given time period.
- Increasing OA reduces the viral load by dilution ventilation.

An illustration of coronavirus particles
Maurizio De Angelis/Science Photo Library

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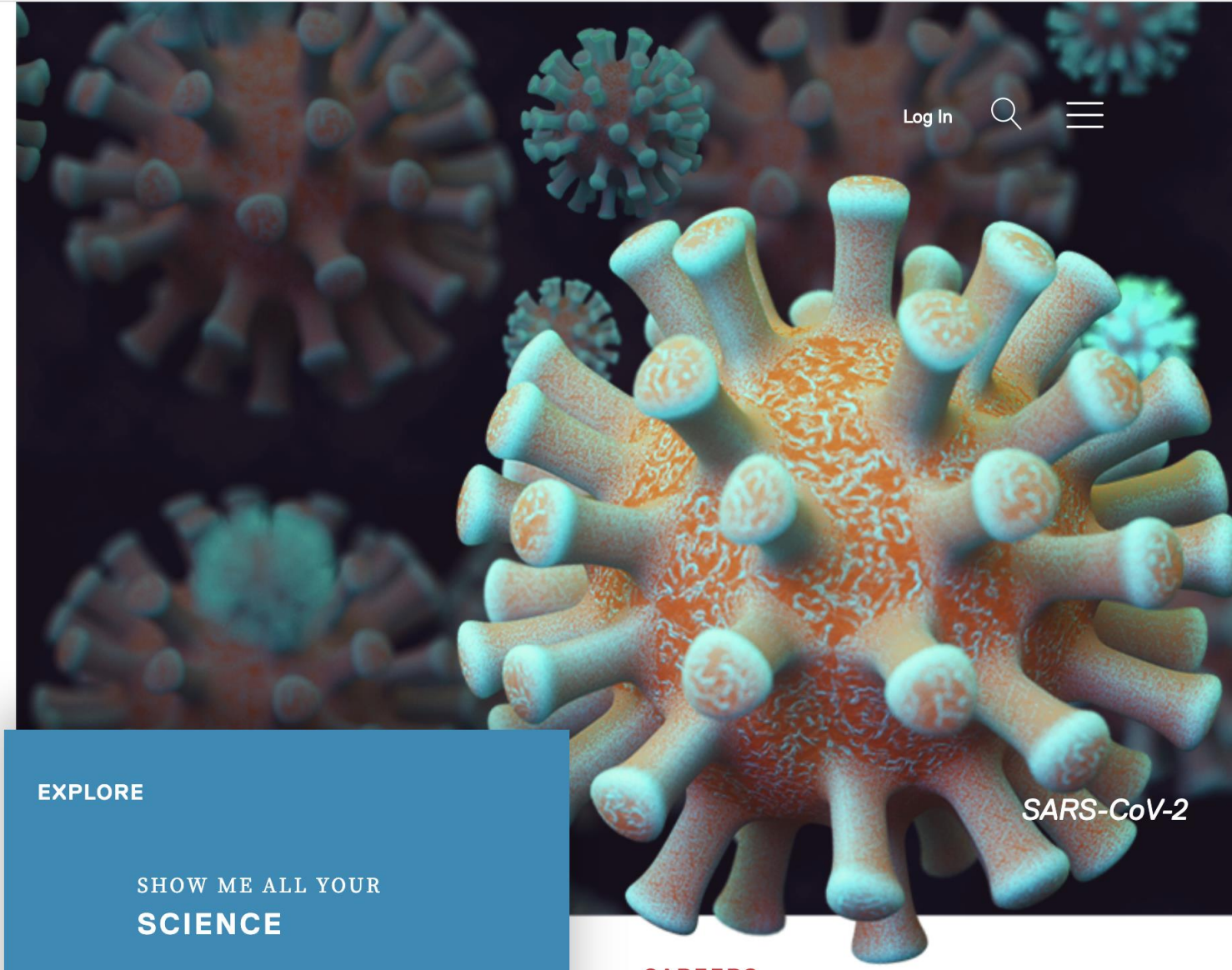

ASM NEWS

COVID-19 Research Registry

This registry includes top-ranked, COVID-19 research articles curated by experts and serves as a resource for scientists working to accelerate scientific research on SARS-CoV-2.

VISIT THE REGISTRY →

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ASM: Ventilation and COVID-19

How does COVID-19 spread from person to person, and why do ventilation and humidity matter?

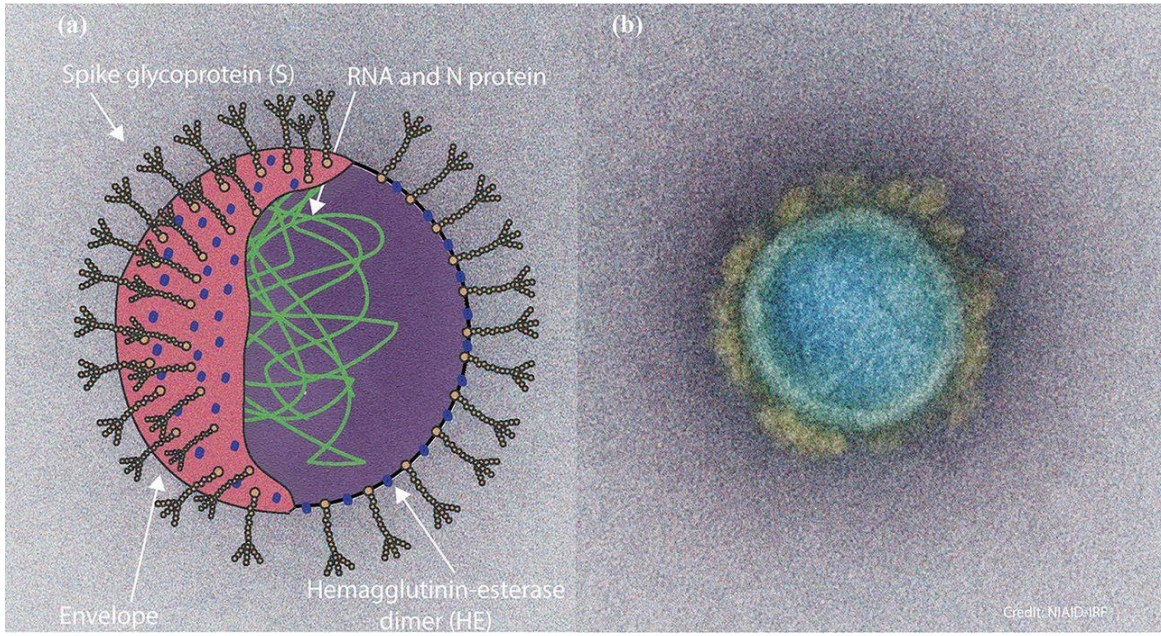
- Respiratory viral droplets are shed through exhaling, coughing, or sneezing. These particles deposit onto surfaces or travel in the air due to airflow patterns (mechanical or natural).
- A non-infected person is at risk of contracting the virus when they touch a surface with a high viral load and then touch mucous membranes in their eyes, nose, or mouth before washing their hands.
- Infection may also occur simply from breathing in an infectious dose of the virus. Experts have differing numbers on this threshold.

Droplets and aerosolized viral particles are expelled from the body through coughing, sneezing, and talking, then spread to commonly touched items such as computers, glasses, faucets, and countertops.

Graphic source: American Society for Microbiology

ASM: Ventilation and COVID-19

- Higher outside air fractions and increased exchange rates can help dilute the viral load indoors.
- "Increasing airflow rates that simply increase the delivery of recirculated indoor air, without increased outside air fraction, could potentially increase the transmission potential."
- This paper indicates relative humidity above 40 percent is detrimental coronaviruses and can slow down airborne dispersal of a virus by encouraging larger droplet formation.



It is essential to understand the potential transmission dynamics of COVID-19 within the built environment, and the ways that human behavior, spatial dynamics, and building operation can mitigate the spread and transmission of COVID-19.

Graphic source: American Society for Microbiology

ASHRAE: Settling Rates

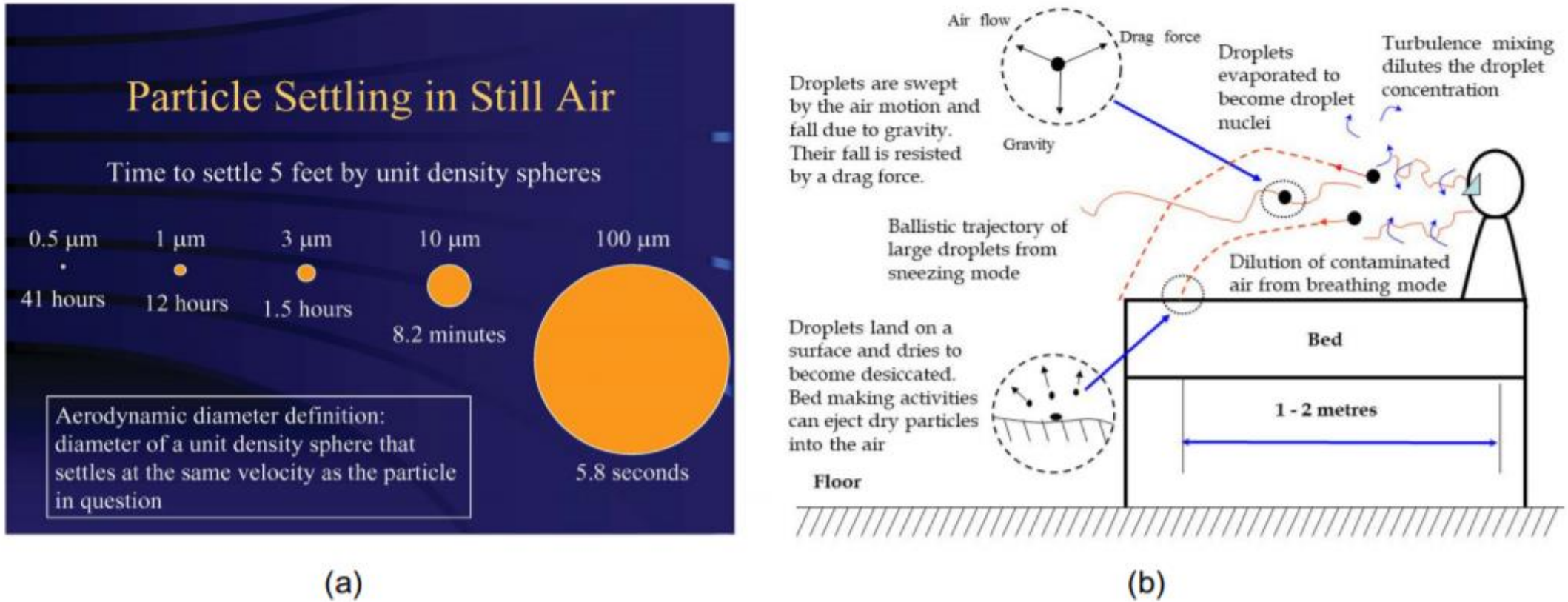
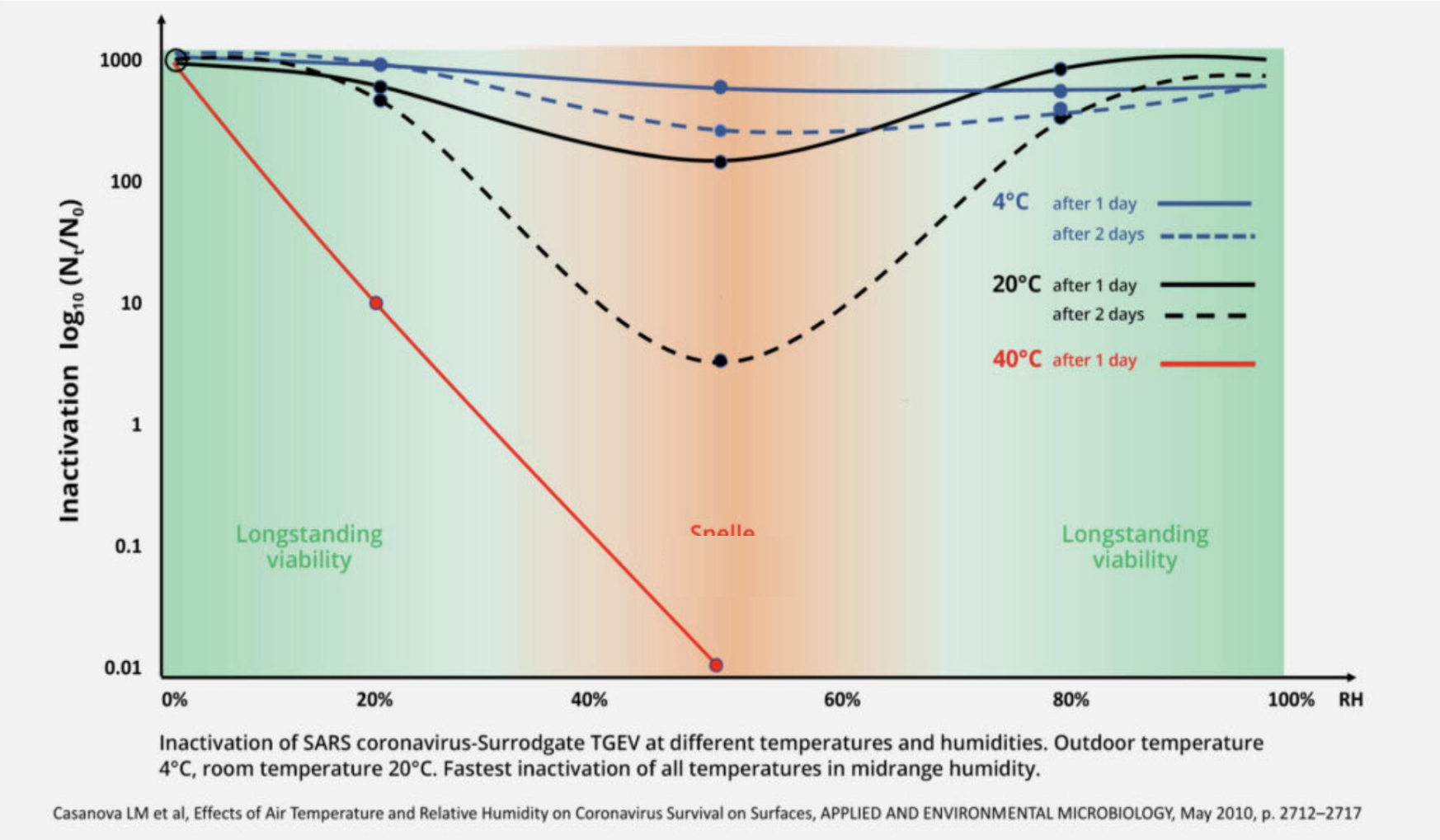


Figure 1 (a) Comparative settling times by particle diameter for particles settling in still air (Baron n.d.) and (b) theoretical aerobiology of transmission of droplets and small airborne particles produced by an infected patient with an acute infection (courtesy Yuguo Li).

Humidity and COVID-19

- Indoor humidity levels above 60% can lead to the presence of other pathogens such as mold.
- Coronavirus naturally inactivates fastest at 50%
- The ideal range for indoor humidity levels is 40% - 60%



Inactivation of SARS coronavirus-Surrodgate TGEV at different temperatures and humidities. Outdoor temperature 4°C, room temperature 20°C. Fastest inactivation of all temperatures in midrange humidity.

Casanova LM et al, Effects of Air Temperature and Relative Humidity on Coronavirus Survival on Surfaces, APPLIED AND ENVIRONMENTAL MICROBIOLOGY, May 2010, p. 2712–2717

Graphic source: Applied and Environmental Microbiology

Q&A

HOW LONG DO WE HAVE TO FOLLOW THE NEW GUIDANCE?

How Long Will This Last?

While we don’t know how long the COVID -19 crises will last, it is clear building operators will need to act on this guidance to open their buildings and keep them open for a prolonged period. We do know that this will end and it will happen again.

- Vaccines are being developed and some testing has begun, but the latest guidance from the White House and medical experts is not to expect a vaccine until 2021 at the earliest.
- COVID crises length "will likely be 18 to 24 months, as herd immunity gradually develops in the human population.“ – Center for Infectious Disease Research and Policy, U of M.

FOLLOWING CDC & ASHRAE GUIDELINES

Sequences of Operation

The following sequences are required to follow the guidance after re-opening a building:

- During occupied hours, open Outside Air (OA) dampers as high as 100% if possible
- Purge the building with fresh outside air for 2 hours before and after occupied hours.
- Disable Demand Control Ventilation – a sequence that uses CO2 sensors to automatically adjust the amount of OA.
- For VAV systems, increase discharge air temperature to max to encourage open VAV terminal dampers.

Sequences of Operation – Outside Air Damper Maximum Opening

RTUs and AHUs are not designed for 100% OA loads. Extreme weather conditions can create very uncomfortable conditions and even worsen risk of infectious aerosols.

Fresh Air Damper

- **Thermostats**:
  - Get on the roof and open up your OA damper
  - If you can open up your OA damper, turn the fan to “on” all the time. “Auto” will cycle on and off
  - If you have an economizer, call an HVAC tech to set the minimum position to 100% if possible
- **Typical Building Automation System**:
  - Edit setting for the OA damper minimum position to 100% if possible & Turn off DCV
- **75F Building Intelligence System** – engage the **75F Epidemic Mode™** sequence that automatically detects the maximum amount of OA any unit can provide for the current weather conditions. As ASHRAE or CDC changes their guidance, updates to the sequence are automatic and over-the-air.

Sequences of Operation – Pre and Post Purge

The guidance to purge the building for 2 hours before and after occupancy can be accomplished these ways:

- **Thermostat**: If you have a programmable thermostat, change your program to start 2 hours before occupancy and end 2 hours after occupancy.
- **Typical BAS**: Edit the fan setting to cover 2 hours before and after occupancy. If not possible, adjust the occupied schedule.
- **75F Building Intelligence System**: Select the **75F Epidemic Mode**™ application and **Smart Purge**™ setting which will automatically start the fan for a 2-hour pre and post purge while keeping the OA damper open.
    - Machine Learning will automatically determine what time to start conditioning for Optimum Start based on predicted weather and previous conditioning rate patterns.
    - As ASHRAE or CDC changes this guidance, updates to the sequence are automatic and over the air.

Sequences of Operation: Maximize Discharge Air Temperature

The guidance to increase discharge air temps – usually 60 degrees – so that VAV terminal units will open more:

- Typical BAS: For systems with modulating cooling capacity, edit the Leaving Air Temperature reset to the highest possible option.
- 75F Building Intelligence System: Select the 75F Epidemic Mode™ setting which will automatically adjust Leaving Air Temperature to the highest option.
  - If ASHRAE or CDC changes the guidance, updates to the sequence are automatic and over-the-air.

Q&A

FIELD EXAMPLE: HOM Furniture

FACILISIGHT DEMONSTRATION

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facilisight.75f.io/#home

75F

John Pierce

Select Building

Search ..

HOM Furniture Lakeville
17055 Kenyon Ave
Lakeville, Minnesota, 55044

HOM Plymouth
4150 Berkshire Ln N Suite H
Plymouth, Minnesota, 55446

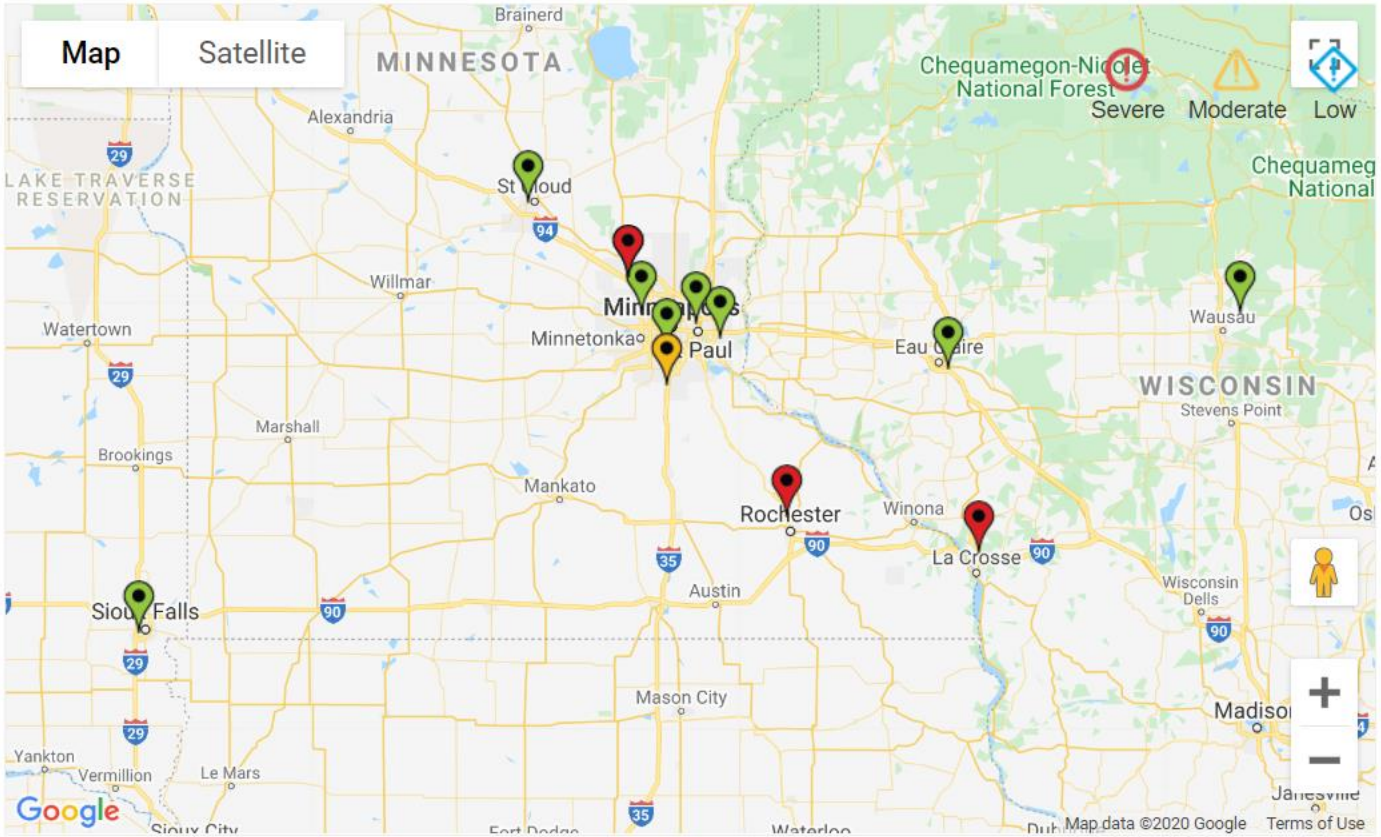
HOM Wausau
300 Forest St
Wausau, Wisconsin, 54403

Hom St. Cloud
3701 W Division St
St Cloud, Minnesota, 56303

Hom Woodbury
7600 Hudson Road
Woodbury, Minnesota, 55125

HOM Little Canada
3201 Country Drive
Little Canada, Minnesota, 55117

Onalaska Hom
9519 State Hwy 16
Onalaska, Wisconsin, 54650



Comfort Index 1.81

Last 2 weeks

0 CCUs

0 Zones

Alerts

Average last 30 days

75F / HOM Plymouth

Last Update : May 19, 2020 10:48 AM

John Pierce

View HeatMap

- 1st Floor
- 2nd Floor

CCU's - RTU-9 RTU-11 RTU-14 RTU-17 RTU-5 RTU-16 RTU-19 RTU-22 RTU-12 RTU-7 RTU-21 RTU-20 RTU-18 RTU-1 RTU-15 RTU-6 RTU-3 RTU-8 RTU-10 RTU-4 RTU-13 RTU-2

Cooler <-6 -4 -2 +2 +4 >+6 Hotter

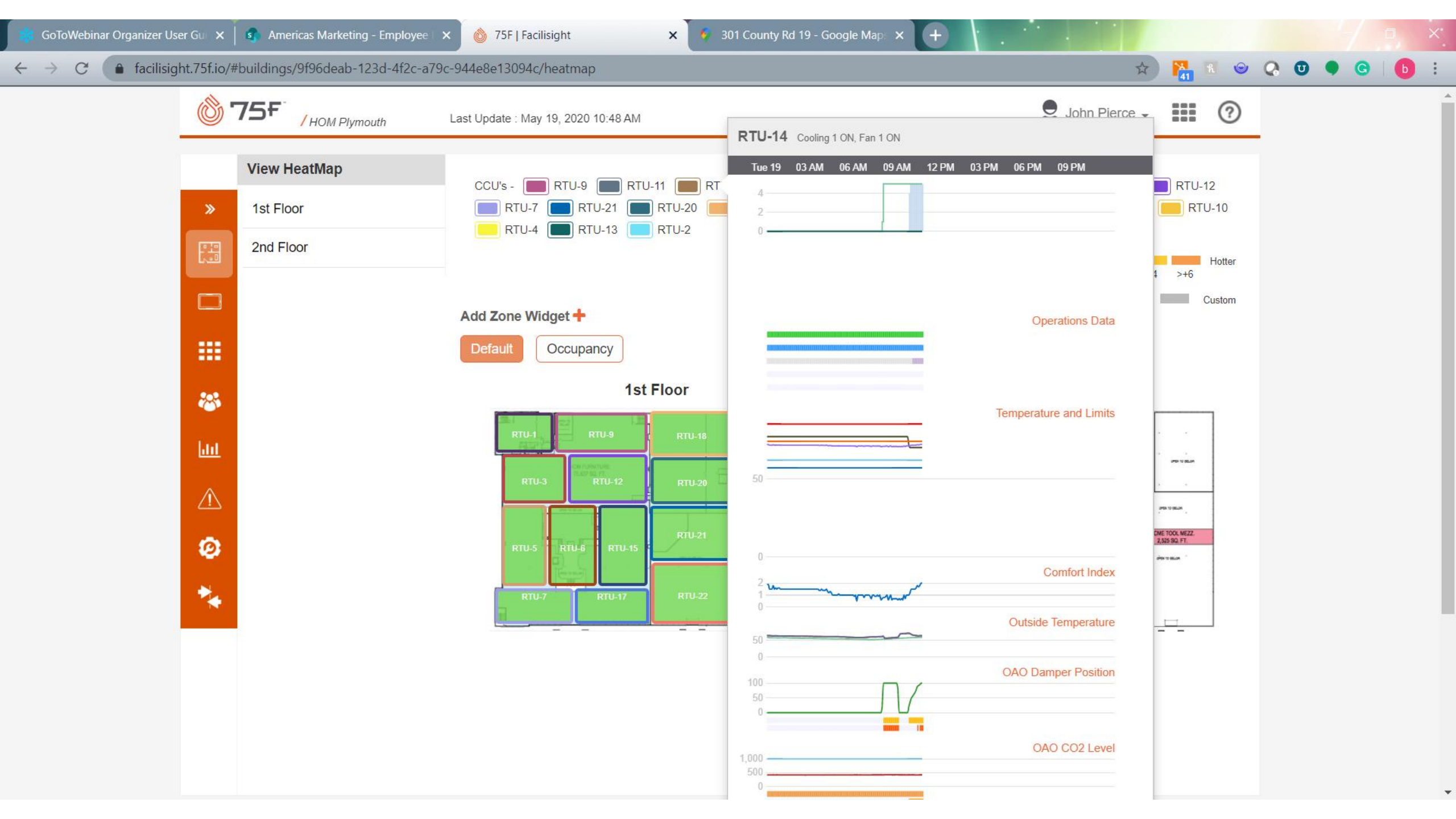
Setback Pure LCM Custom

Add Zone Widget +

Default | Occupancy

1st Floor

2nd Floor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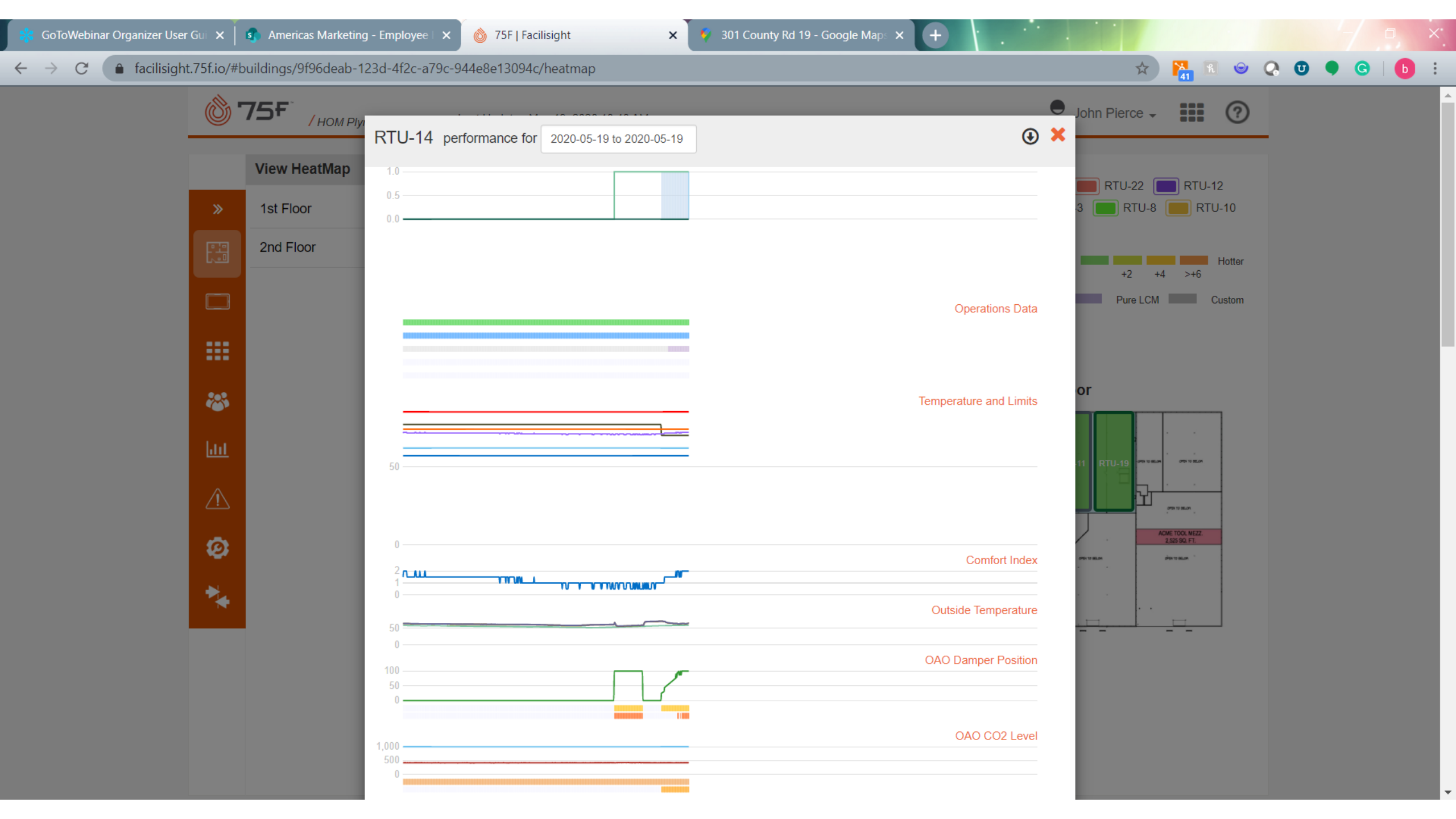
75F
/ HOM Plymouth
Last Update : May 19, 2020 10:48 AM
John Pierce
View HeatMap
1st Floor
2nd Floor
CCU's -
RTU-9
RTU-11
RTU-7
RTU-21
RTU-20
RTU-4
RTU-13
RTU-2
RTU-12
RTU-10
Hotter
>+6
Custom
Add Zone Widget
Default
Occupancy
1st Floor
RTU-1
RTU-9
RTU-18
RTU-3
RTU-12
RTU-20
RTU-5
RTU-6
RTU-15
RTU-21
RTU-7
RTU-17
RTU-22
RTU-14
Cooling 1 ON, Fan 1 ON
Tue 19
03 AM
06 AM
09 AM
12 PM
03 PM
06 PM
09 PM
Operations Data
Temperature and Limits
Comfort Index
Outside Temperature
OAO Damper Position
OAO CO2 Level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301 County Rd 19 - Google Maps
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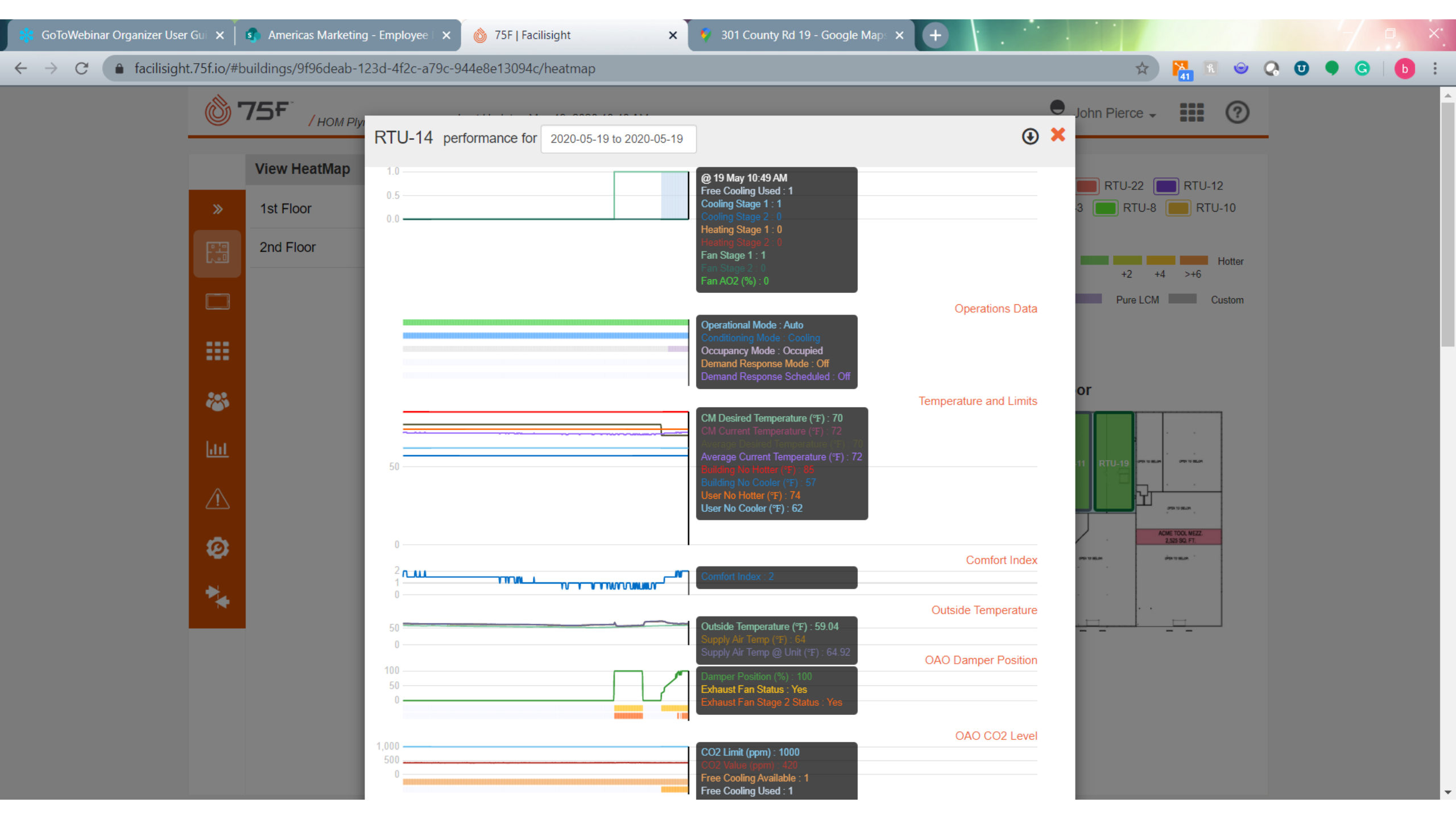
75F
John Pierce
View HeatMap
1st Floor
2nd Floor
RTU-14 performance for 2020-05-19 to 2020-05-19
Operations Data
Temperature and Limits
Comfort Index
Outside Temperature
OAO Damper Position
OAO CO2 Level
RTU-22
RTU-12
RTU-8
RTU-10
Hotter
+2
+4
>+6
Pure LCM
Custom
RTU-19
ACME TOOL MEZZ.
2,525 SQ. FT.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301 County Rd 19 - Google Maps
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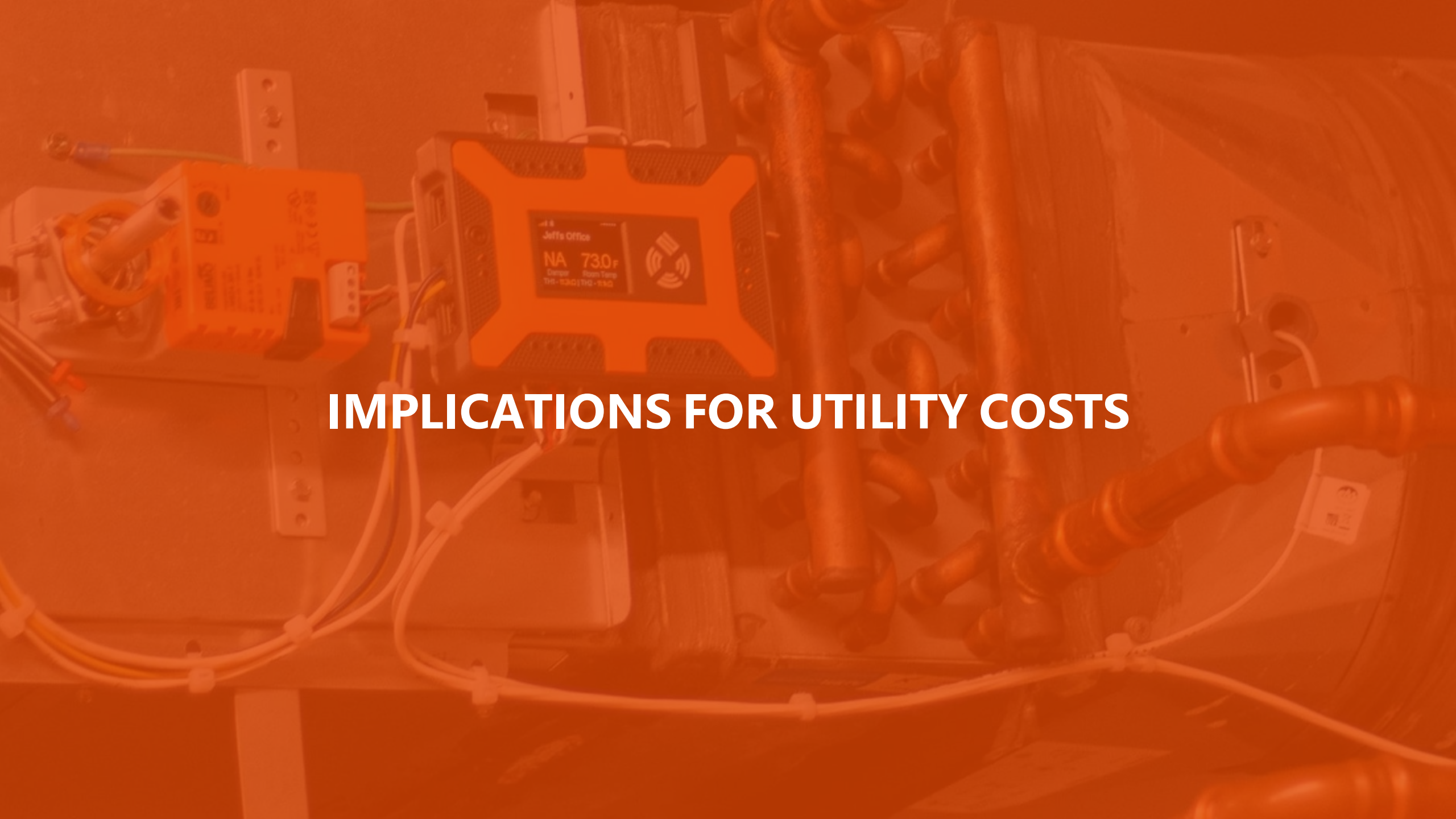
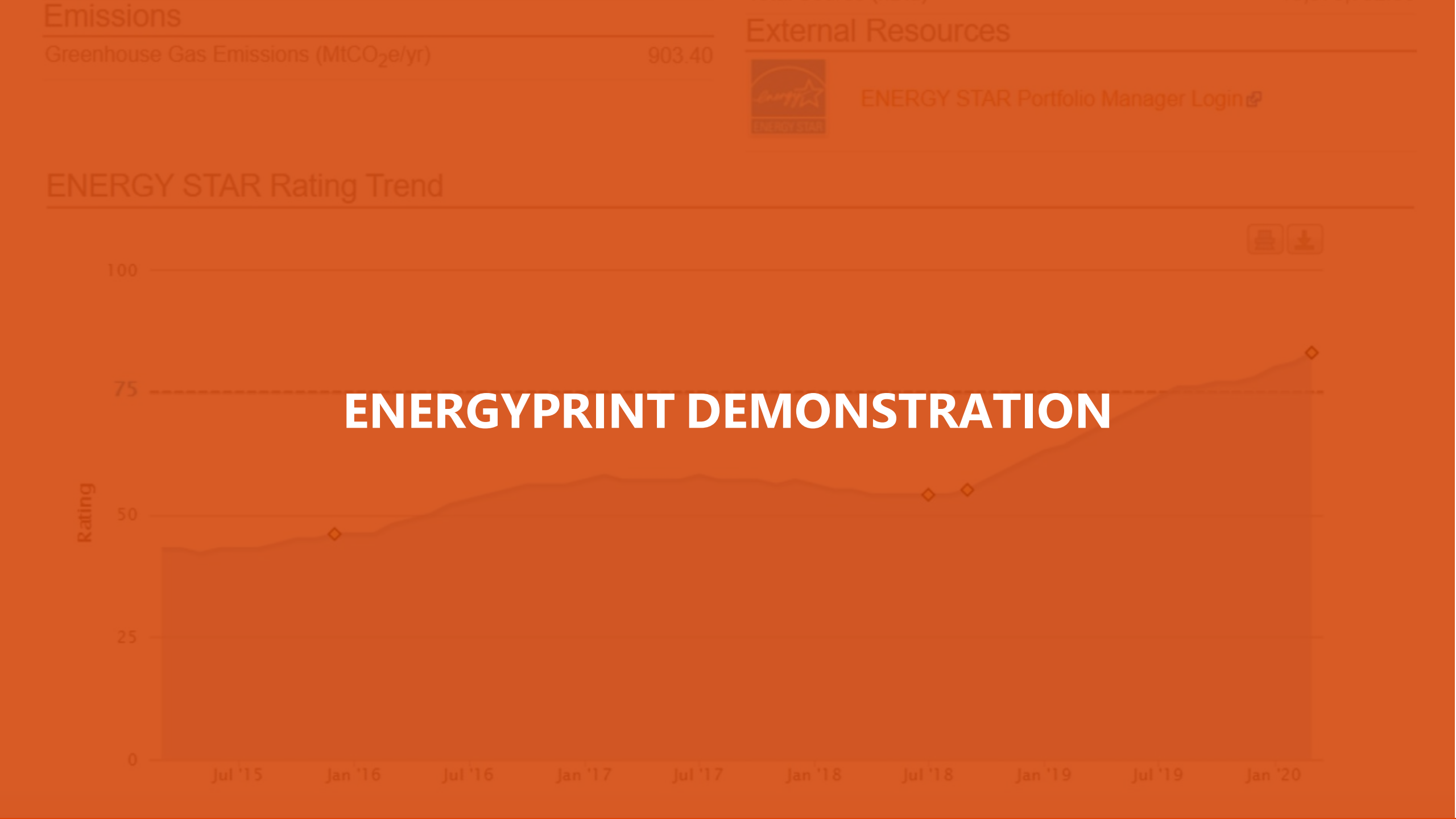
75F
John Pierce
View HeatMap
1st Floor
2nd Floor
RTU-14 performance for 2020-05-19 to 2020-05-19
@ 19 May 10:49 AM
Free Cooling Used : 1
Cooling Stage 1 : 1
Cooling Stage 2 : 0
Heating Stage 1 : 0
Heating Stage 2 : 0
Fan Stage 1 : 1
Fan Stage 2 : 0
Fan AO2 (%) : 0
Operations Data
Operational Mode : Auto
Conditioning Mode : Cooling
Occupancy Mode : Occupied
Demand Response Mode : Off
Demand Response Scheduled : Off
Temperature and Limits
CM Desired Temperature (°F) : 70
CM Current Temperature (°F) : 72
Average Desired Temperature (°F) : 70
Average Current Temperature (°F) : 72
Building No Hotter (°F) : 85
Building No Cooler (°F) : 57
User No Hotter (°F) : 74
User No Cooler (°F) : 62
Comfort Index
Comfort Index : 2
Outside Temperature
Outside Temperature (°F) : 59.04
Supply Air Temp (°F) : 64
Supply Air Temp @ Unit (°F) : 64.92
OAO Damper Position
Damper Position (%) : 100
Exhaust Fan Status : Yes
Exhaust Fan Stage 2 Status : Yes
OAO CO2 Level
CO2 Limit (ppm) : 1000
CO2 Value (ppm) : 420
Free Cooling Available : 1
Free Cooling Used : 1
RTU-22
RTU-12
RTU-8
RTU-10
Hotter
+2
+4
>+6
Pure LCM
Custom
RTU-19
ACME TOOL MEZZ.
2,525 SQ. FT.



IMPLICATIONS FOR UTILITY COSTS



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Your Rank

8.0 CURRENT 12 MO

8.2 IMPROVEMENT RANK

Your Usage

20 of 23 Properties Current Through 03/2020

Cost	Consumption	Carbon
$0.79	42.14 kBtu	13.45 lbs.
PREVIOUS 12 MO. $0.90	PREVIOUS 12 MO. 48.40 kBtu	PREVIOUS 12 MO. 14.81 lbs.

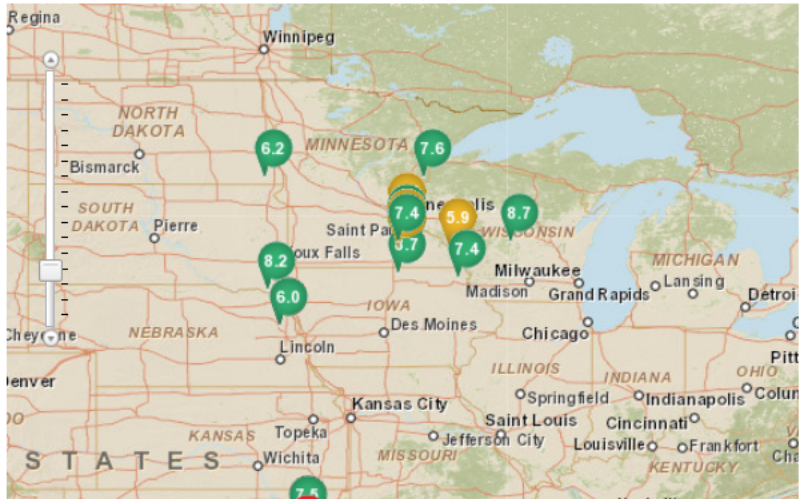
Property Map

View by: Property Name ▾ Ascending ▾

8.1
static HOM Furniture-Bloomington
7800 Dupont Ave S.
Minneapolis, MN 55420

7.7
Dock 86-Little Canada
3201 Country Drive
Saint Paul, MN 55117

3.0
Harrison Energy Partners - Tulsa
11414 E. 51st Street Suite A



Let's Chat!

Property Profile | ENERGY STAR | Weather Profile | Cost Avoidance

Property current through 03/2020

Property Rank

	PREVIOUS 12 MO	CURRENT 12 MO	IMPROVEMENT RANK
EnergyPrint Rank	7.7	9.0	9.8

Property Info

Address	4150 Berkshire Lane N Minneapolis, MN View Map
Annual Energy Cost	$177,732.30
Square Footage	179,837
Year Built	1984
Primary Use	Retail - Retail Store
Primary Construction Type	Steel

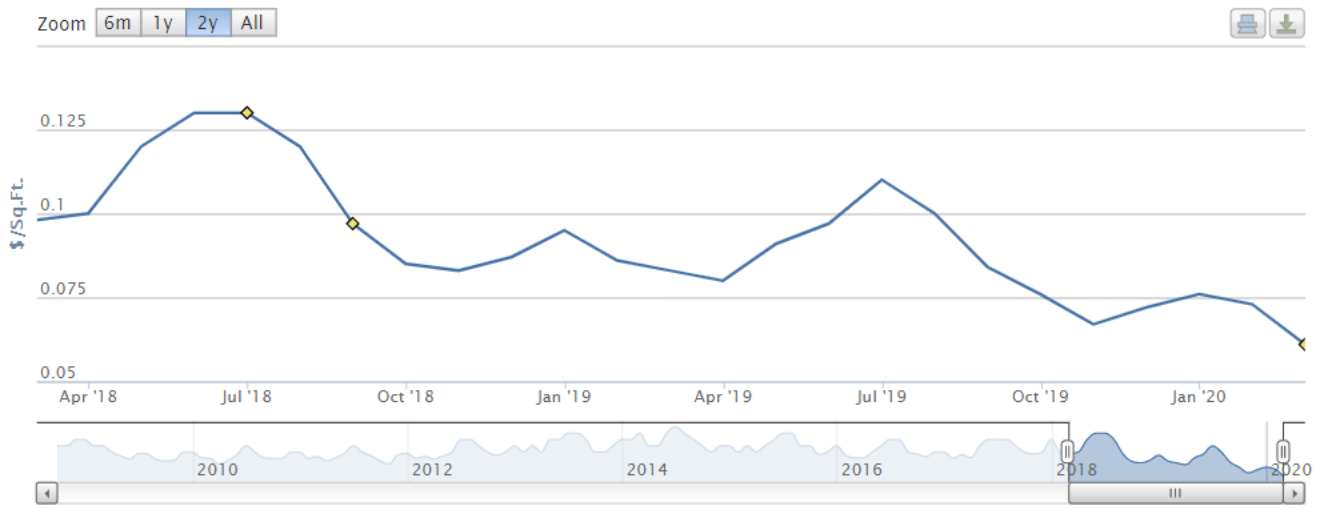
Property Snapshot

Energy Type: All

UNITS	PREVIOUS 12 MO	CURRENT 12 MO	% CHANGE
Cost/SF	$1.21	$0.99	-18.3%
Consumption/SF	48	33	-31.1%
Carbon/SF	16.75	13.39	-20.1%

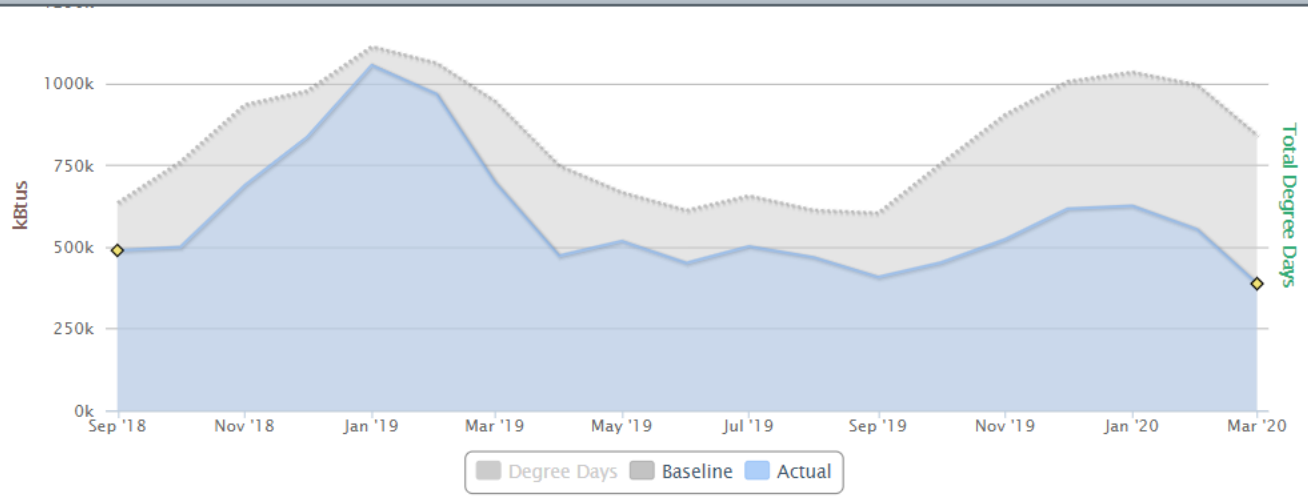
Property Energy Trends

Metric: Cost | Energy Type: All



HOM Furniture-Plymouth

Let's Chat!



Month	Actual kBtus	Baseyear Month	Baseyear Adjustments kBtus	Baseline kBtus	Cons. Avoidance kBtus	Cost Avoidance
09/2018	488,543.39	09/2017	10,000.00	634,206.58	145,663.19	$4,370.50
10/2018	498,081.94	10/2017	0.00	759,131.38	261,049.44	$5,101.76
11/2018	686,996.56	11/2017	0.00	934,235.66	247,239.10	$4,351.27
12/2018	834,802.86	12/2017	0.00	975,991.44	141,188.58	$3,685.96
01/2019	1,054,670.37	01/2018	0.00	1,111,533.20	56,862.83	$2,955.65
02/2019	966,403.69	02/2018	0.00	1,061,367.76	94,964.06	$3,595.39
03/2019	697,775.08	03/2018	0.00	945,168.22	247,393.14	$3,988.15
04/2019	472,009.36	04/2018	0.00	747,283.79	275,274.42	$4,371.10
05/2019	516,842.76	05/2018	0.00	666,436.25	149,593.49	$4,148.43
06/2019	449,731.86	06/2018	0.00	611,221.17	161,489.31	$4,701.08
07/2019	500,745.12	07/2018	0.00	655,880.28	155,135.16	$4,356.21
08/2019	467,597.15	08/2018	0.00	611,769.36	144,172.22	$4,088.05
09/2019	406,828.56	09/2017	10,000.00	603,241.40	196,412.83	$6,352.49
10/2019	450,403.59	10/2017	0.00	753,354.19	302,950.60	$7,042.29
11/2019	521,823.92	11/2017	0.00	903,778.07	381,954.16	$6,053.39
12/2019	615,877.66	12/2017	0.00	1,004,840.23	388,962.57	$4,567.37

Property Profile | ENERGY STAR | Weather Profile | Cost Avoidance

Property current through 03/2020

ENERGY STAR PARTNER

Energy Performance Rating 83*

Facility Overview

Address	4150 Berkshire Lane N. Minneapolis, MN 55446
SF	179,837
Year Built	1984

Emissions

Greenhouse Gas Emissions ($MtCO_2e/yr$)	903.40

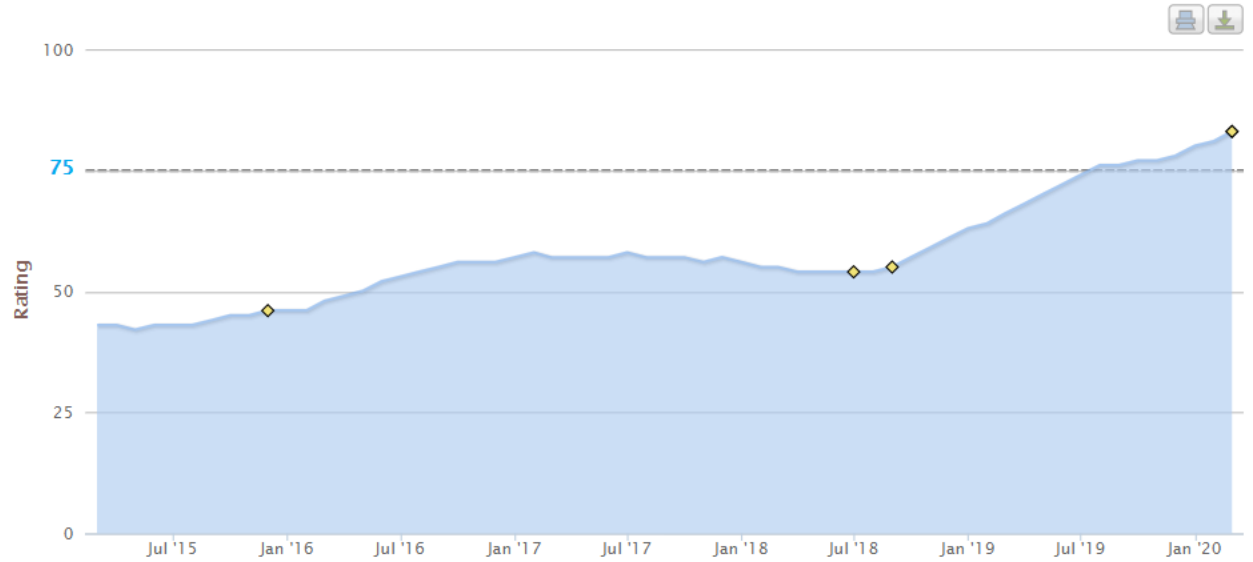
Energy Intensity

Site (kBtu/SF/yr)	33.20
Source (kBtu/SF/yr)	85.50
Total Site (kBtu)	5,966,796.20
Total Source (kBtu)	15,370,752.60

External Resources

ENERGY STAR Portfolio Manager Login

ENERGY STAR Rating Trend



Notes:

Q&A

Bob French

bob@75F.io

651-261-3942