Passive House Massachusetts

Performance Data and Building Operations

Lessons from Hotel Marcel

December 10, 2024

Bruce Redman Becker, FAIA, LEED AP, CPHD
Becker + Becker

Hotel Marcel

Cary Institute of Ecosystem Studies

777 Main

360 State

The Octagon

The Wauregan


HOTEL
MARCEL


EnerPHit
Certified
Retrofit
Passive House Institute
THIS PROPERTY
HAS BEEN LISTED IN THE
NATIONAL REGISTER
OF HISTORIC PLACES
BY THE UNITED STATES
DEPARTMENT OF THE INTERIOR
LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN
LEED
PLATINUM
2023

HOTEL MARCEL'S DECARB TOOLKIT

Fuel Switching to Eliminate CO2 Emissions

1. Hot Water – HW heat pumps instead of gas/oil HW
2. HVAC– Heat Pumps instead of boilers
3. Kitchen – Induction ranges instead of gas ranges
4. Laundry – Heat pump dryers instead of gas dryers
5. Emergency Power - Batteries instead of generator
6. Shuttle – Electric van instead of gas shuttle

Energy Savings to Enhance NOI & Value

1. Passive House Building Envelope
2. Energy Recovery Ventilation
3. Power of Ethernet/DC Lighting System
4. Regenerative Elevators
5. Building controls and monitoring

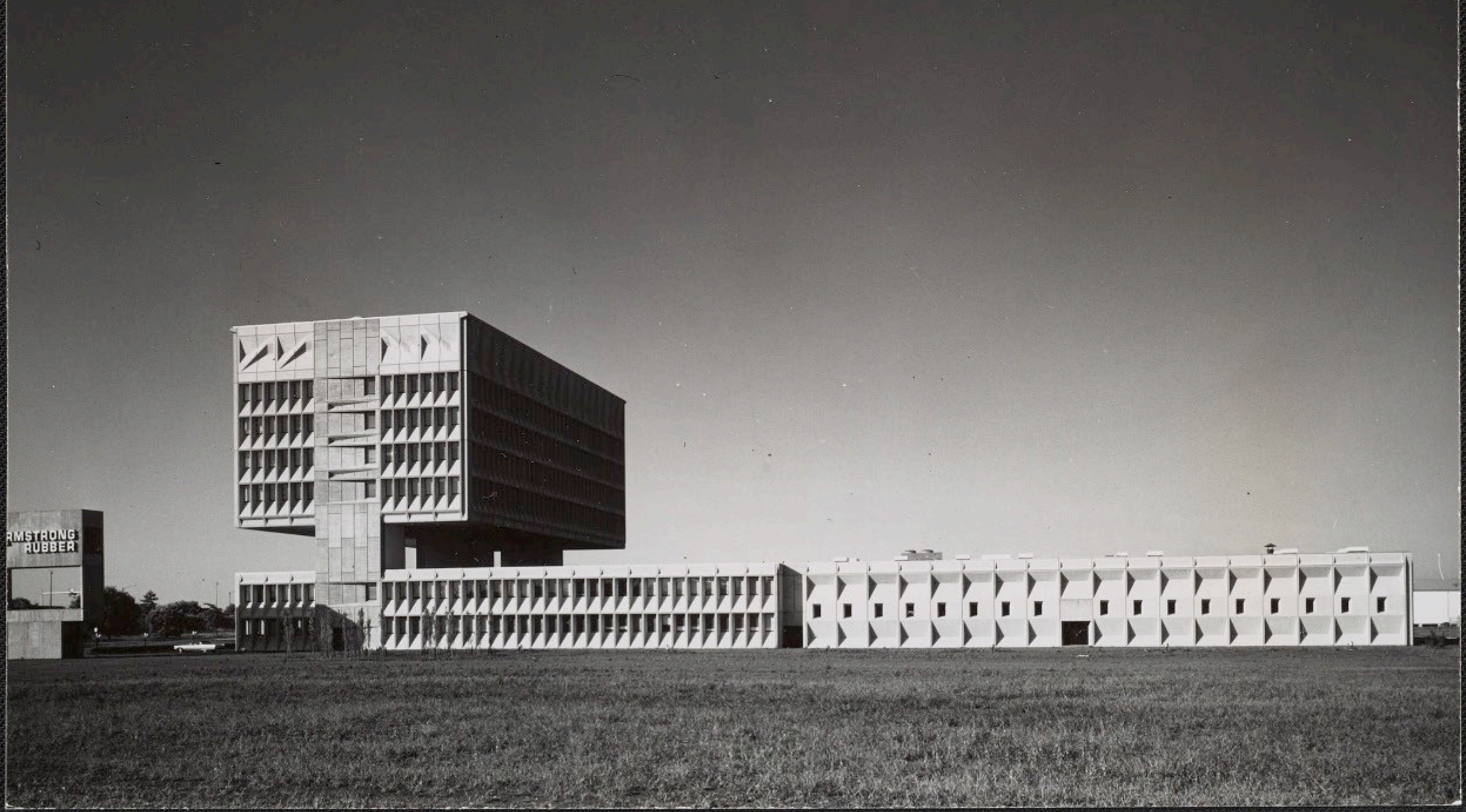
Solar Microgrid to Enhance NOI & Value

1. Solar Carports and Roof to reduce energy costs
2. Battery peak shaving, export & demand response
3. Community Solar to reach Net Zero Goal

Incentives to Fund Capital Costs

1. 30-50% IRA tax credit for solar & batteries
2. Utility Incentives and State Agency Rebates
3. CPACE Financing paid for from energy savings


ARMSTRONG
RUBBER


RMSTRONG
RUBBER

Hotel Marcel – Program for Reinvention

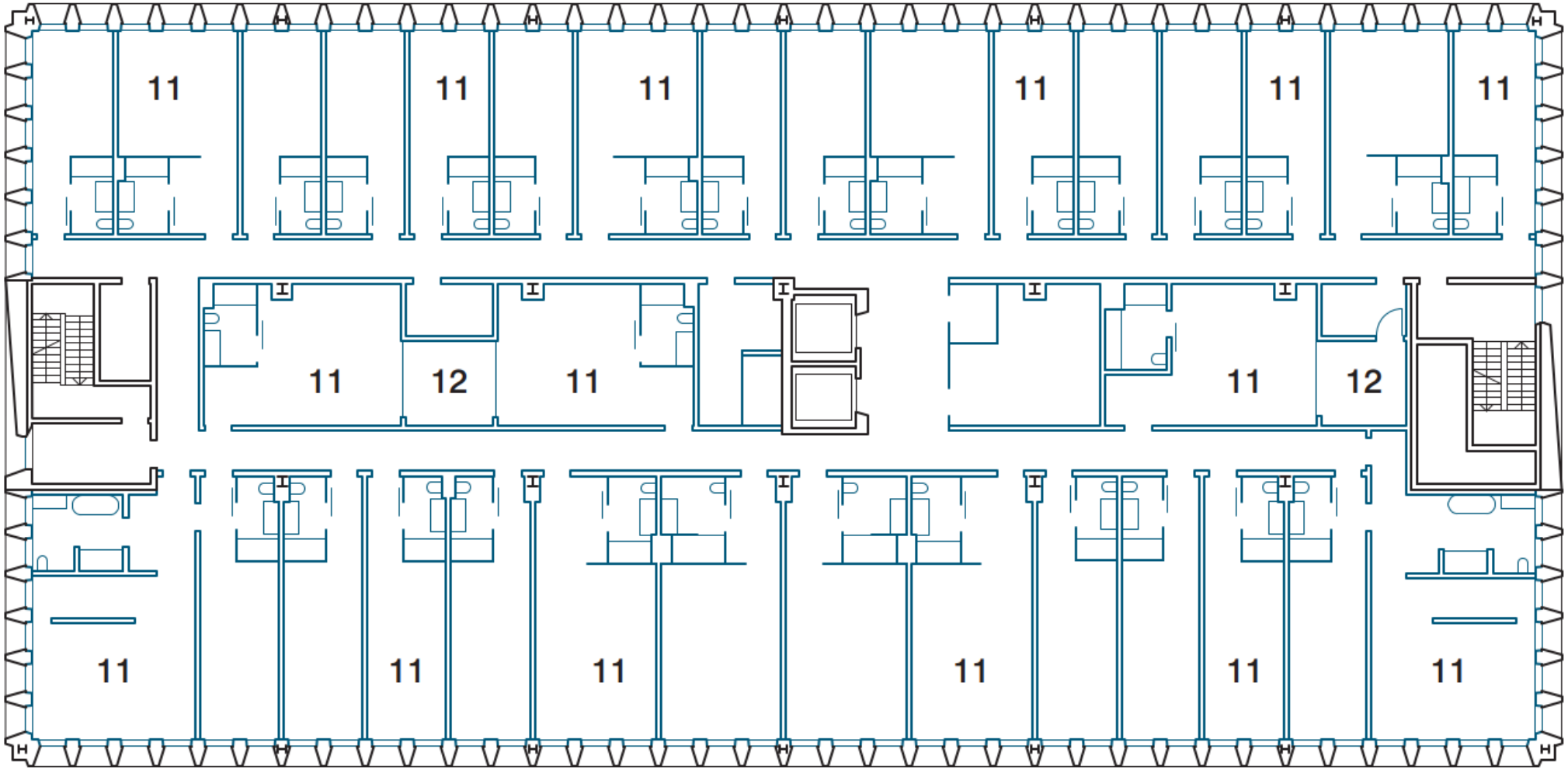
- 165 room Boutique Hotel, including restaurant, 9,000 sf of meeting space
- Listed on National Register of Historic Places
- Certified historic rehabilitation (approved by National Park Service and SHPO)
- Meet standards required for inclusion in Tapestry Collection by Hilton

Sustainability Program

- LEED Platinum Certification (one of only about a dozen such hotels in United States)
- Passive House Certification (believed to be first such hotel in United States)
- No use of fossil fuels (including 100% of HVAC, hot water, kitchen and laundry)
- All electric building (no natural gas connection)
- Targeting Net zero energy (expected to be first such hotel in United States)
- Use of Power over Ethernet (POE) for all Lighting and Shades
- Creation of Micro-grid for resilience with 1.5 megawatt hours of battery storage

GROUND FLOOR

SIXTH FLOOR PLAN



11 – Suite
12 – Light courtyard

Sixth Floor Plan



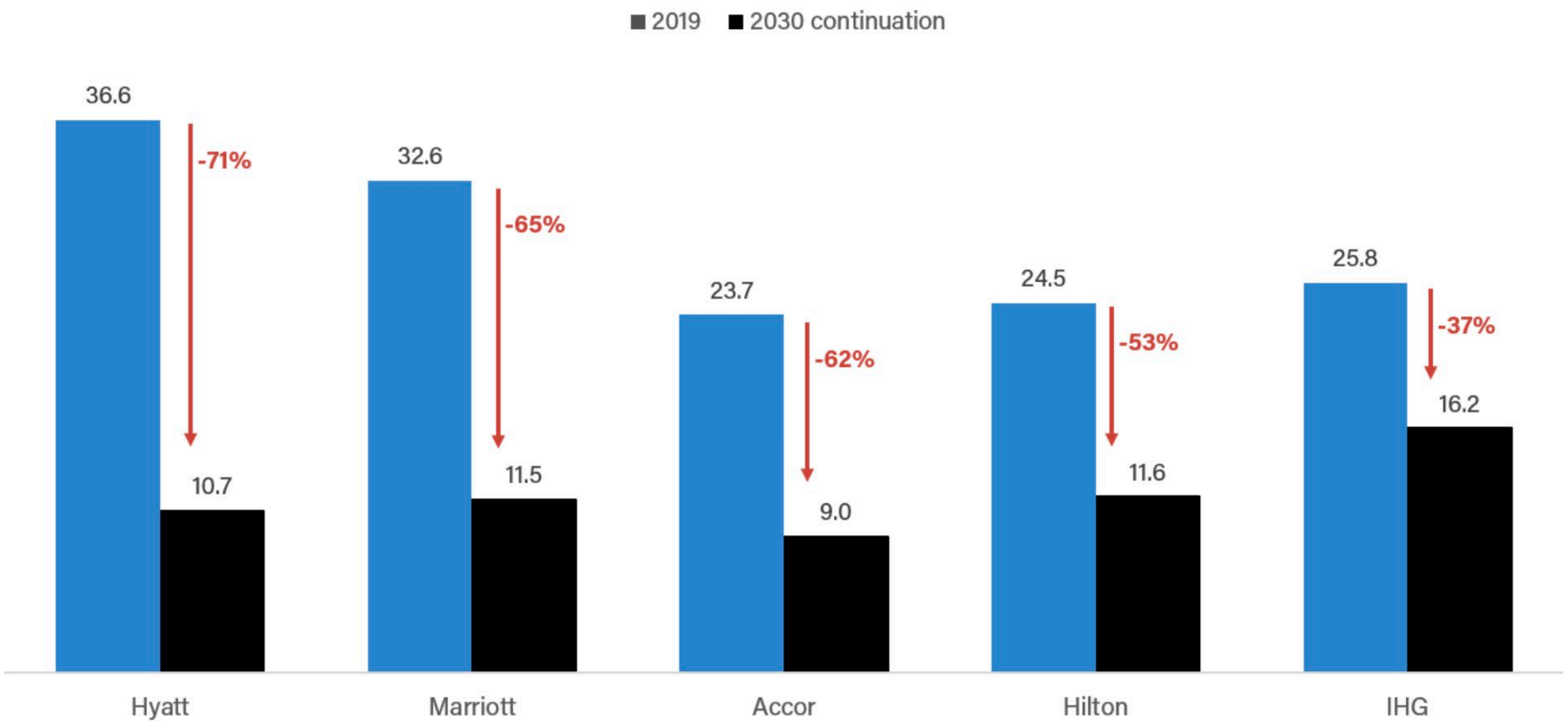



NINTH FLOOR

MICROGRID OPERATION MONITORING

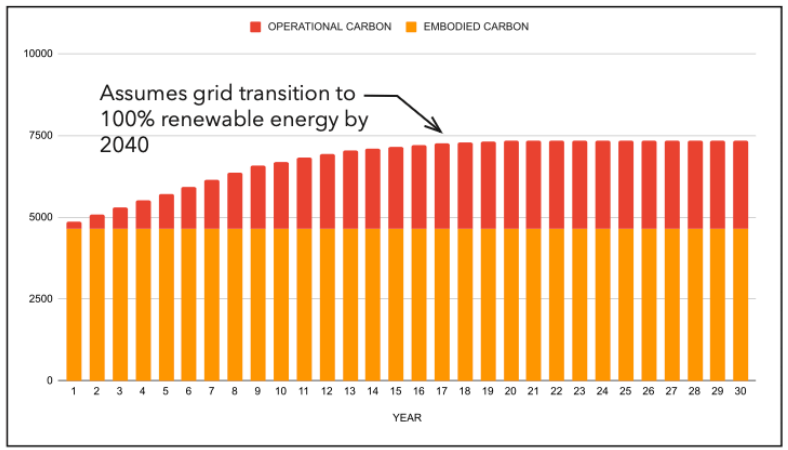
Emissions (kg CO_2e) per Occupied Room in 2019 and 2030 Target

Systemwide, scope 1, 2, and 3 (Franchise only)

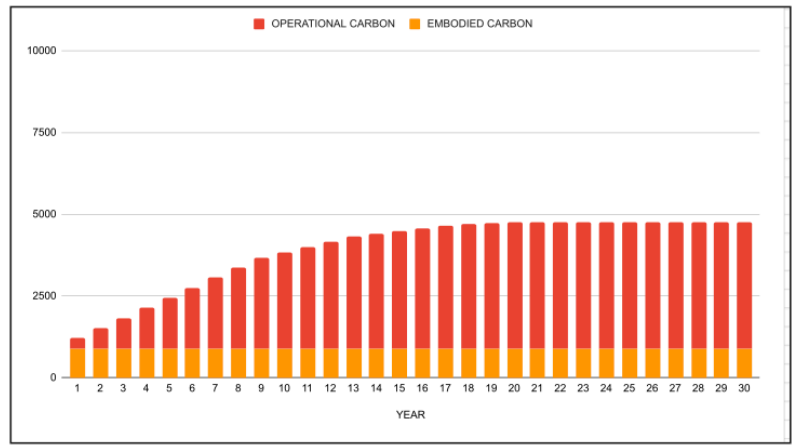


Source: Skift Research from CDP, company filings and estimates, March 2023

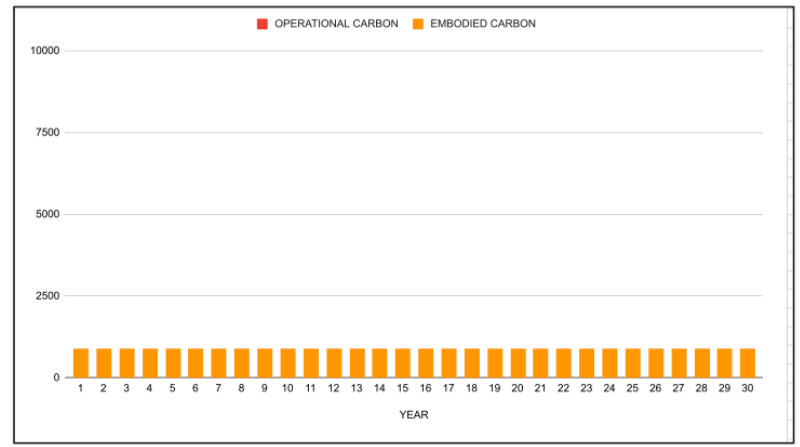
REUSING AN EXISTING BUILDING RESULTS IN LOWER LIFETIME CARBON EMISSIONS COMPARED TO BUILDING A NEW BUILDING, EVEN IF THE NEW BUILDING IS MORE EFFICIENT.



30-YEAR CUMULATIVE CO2 EMISSIONS NEW BUILDING



30-YEAR CUMULATIVE CO2 EMISSIONS RECYCLED BUILDING



30-YEAR CUMULATIVE CO2 EMISSIONS HOTEL MARCEL

DHW

100% ELECTRIC KITCHEN

100% ELECTRIC LAUNDRY

THE LAUNDRY

Compressed Air Connection	1/4" Quick Connection
Compressed Air Volume	
Inlet Pipe Connection	
	ustralia Only)
Voltage Available	50/60 Hz
Approximate Net Weight	
Approximate Shipping Weight	
Airflow 60 Hz	
50 Hz	
Exhaust Connection (Diameter)	
Compressed Air Connection	
Compressed Air Volume	0.12 cmh

Oven Size		
kW	Btu/hr	kcal/hr
126	429,900	108,300

Voltage Available	208-480V 3ø 3,4w 50/60 Hz
Approximate Net Weight	2,259 lb (1,024.67 kg)
Approximate Shipping Weight	2,425 lb (1,099.96 kg)
Airflow 60 Hz	4,400 cfm (124.59 cmm)
50 Hz	4,400 cfm (124.59 cmm)
Steam Consumption	520 lb/hr (236 kg/hr)

AD-170 OPL Dryer

Outstanding productivity

Dry more laundry in less time: a game-changing improvement

- Reversing drum
  Minimizes wrinkles and drying time to get an effective and even drying performance

Main options and accessories

- Insulated glass door keeps the door cool on the outside and heat on th inside, so the room temperature is not affected
- Lagoon Advanced Care
- Drum Speed Control adjusts the movement of the drum to help garmen move correctly for a faster drying process
- Door, front and side panels are available in stainless steel
- Connectable to booking-/payment system or coin meter

Main specifications		TD6-20
Rated capacity, filling factor 1:18	kg/lb	20.0/44.1
filling factor 1:22	kg/lb	16.4/36.2
Drum volume	litre	360
Drum diameter	mm	755
Rated input	kW	6.5

Consumption data*

Total time full load	min	44
Energy consumption full load	kWh	2.99
Evaporation	g/min	185
Energy kWh/litre water evaporated	kWh/l	0.36

* At rated capacity 1:22, 100% cotton load at 50% initial moisture dryed to 0%


guestsupply


AO Smith


TESLA


PowerCharge
This EV charger managed by
evconnect
To use this charging station:
Download & launch the EV Connect app
Scan the QR Code or type in Station ID
Press Charge Now, then plug in vehicle
Or tap your access card
Tap EVConnect Card Here
STATION PORT ID
PC1857
We're Here to Help!
If you are experiencing issues with this charging station, please contact EVConnect Driver Support at:
(866) 816-7584
PowerCharge
This EV charger managed by
evconnect
To use this charging station:
Download & launch the EV Connect app
Scan the QR Code or type in Station ID
Press Charge Now, then plug in vehicle
Or tap your access card
Tap EVConnect Card Here
STATION PORT ID
PC1853
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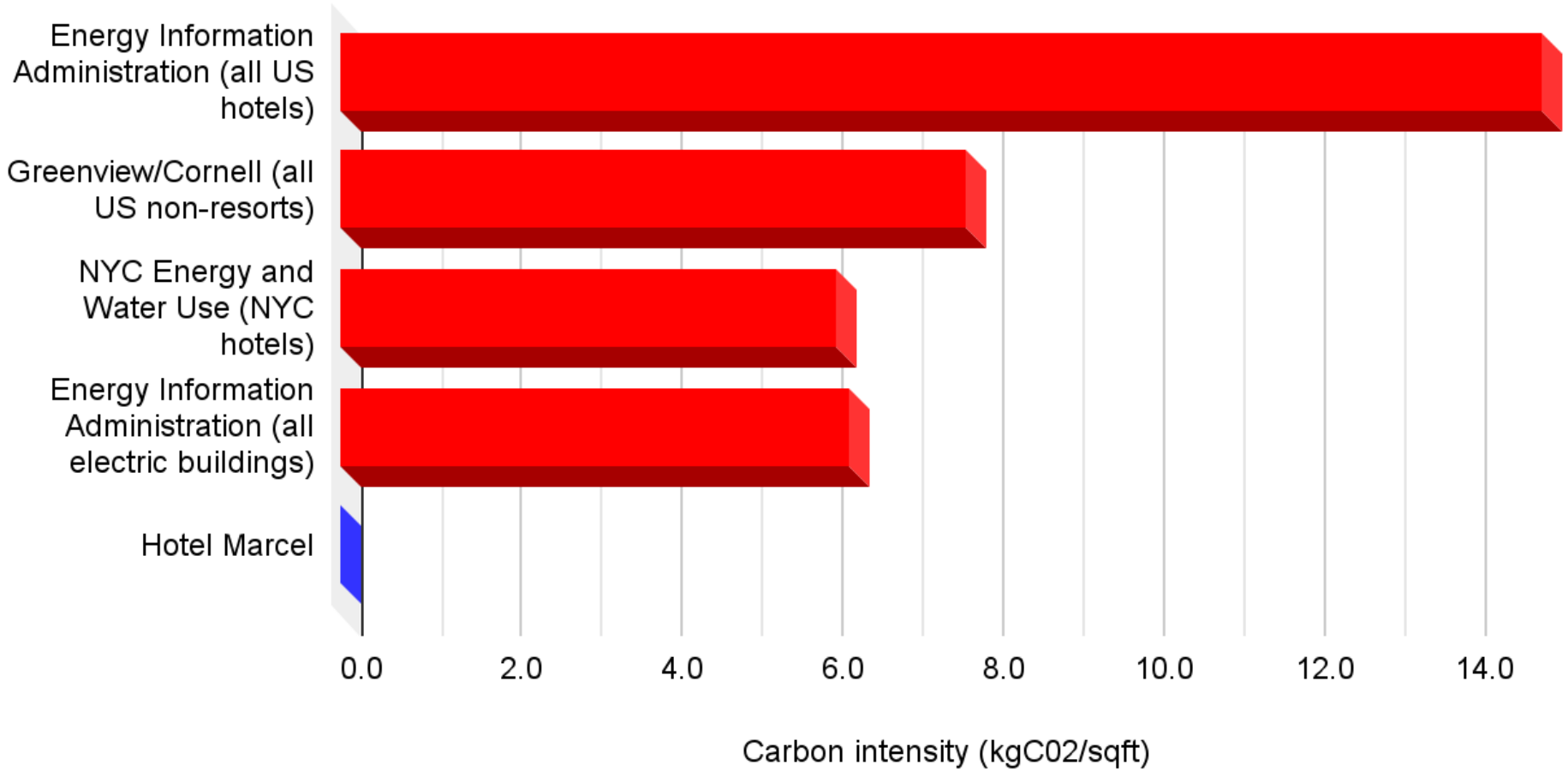
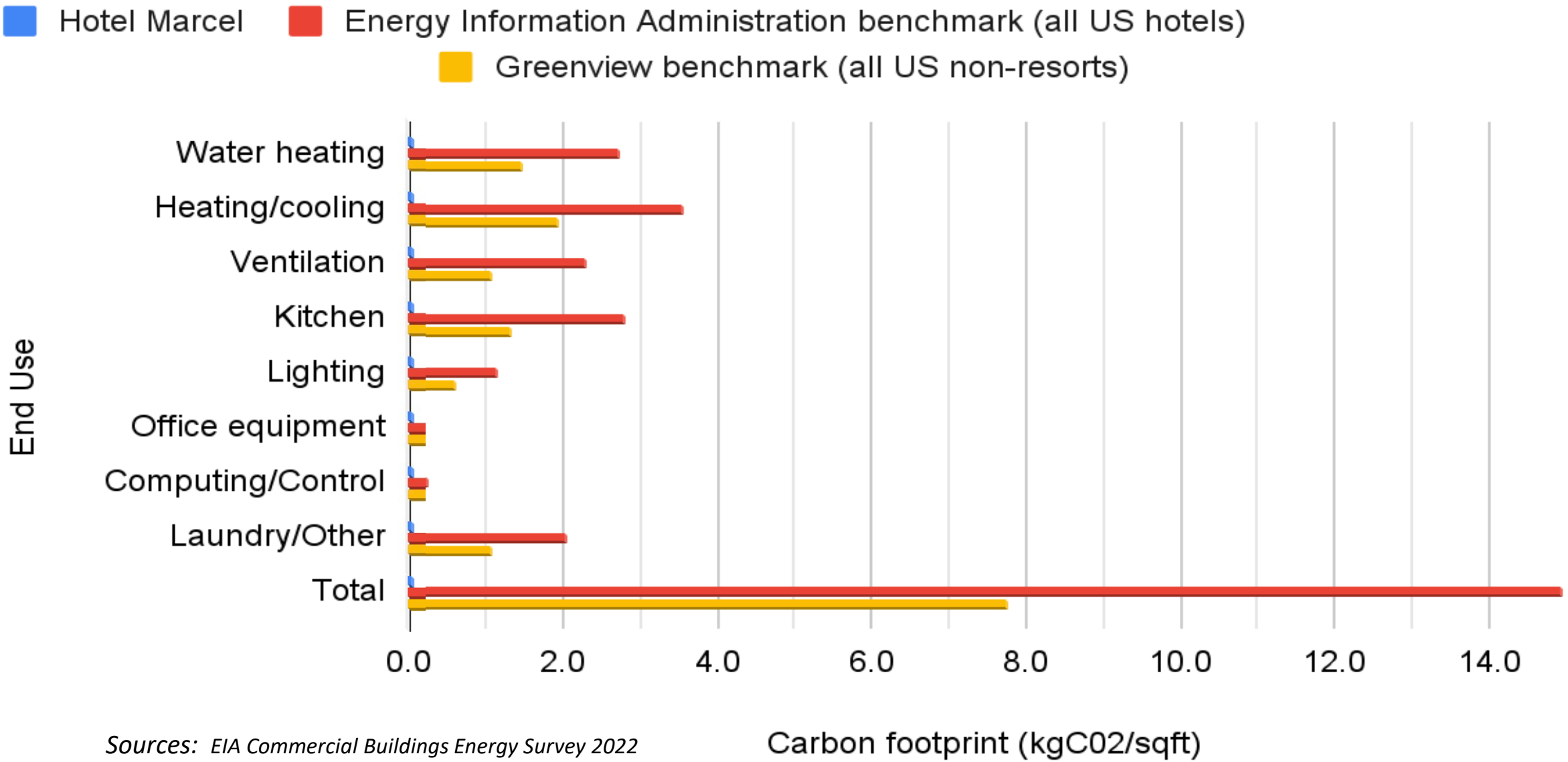
HOTEL MARCEL
MARCEL

Mean Operational Carbon Footprint of Hotel Marcel vs. Industry Benchmarks



Sources: *EIA Commercial Buildings Energy Survey 2022*
Cornell Hotel Sustainability Benchmarking 2023
NYC Energy and Water Use Report 2020

Mean Operational Carbon Footprint by End Use



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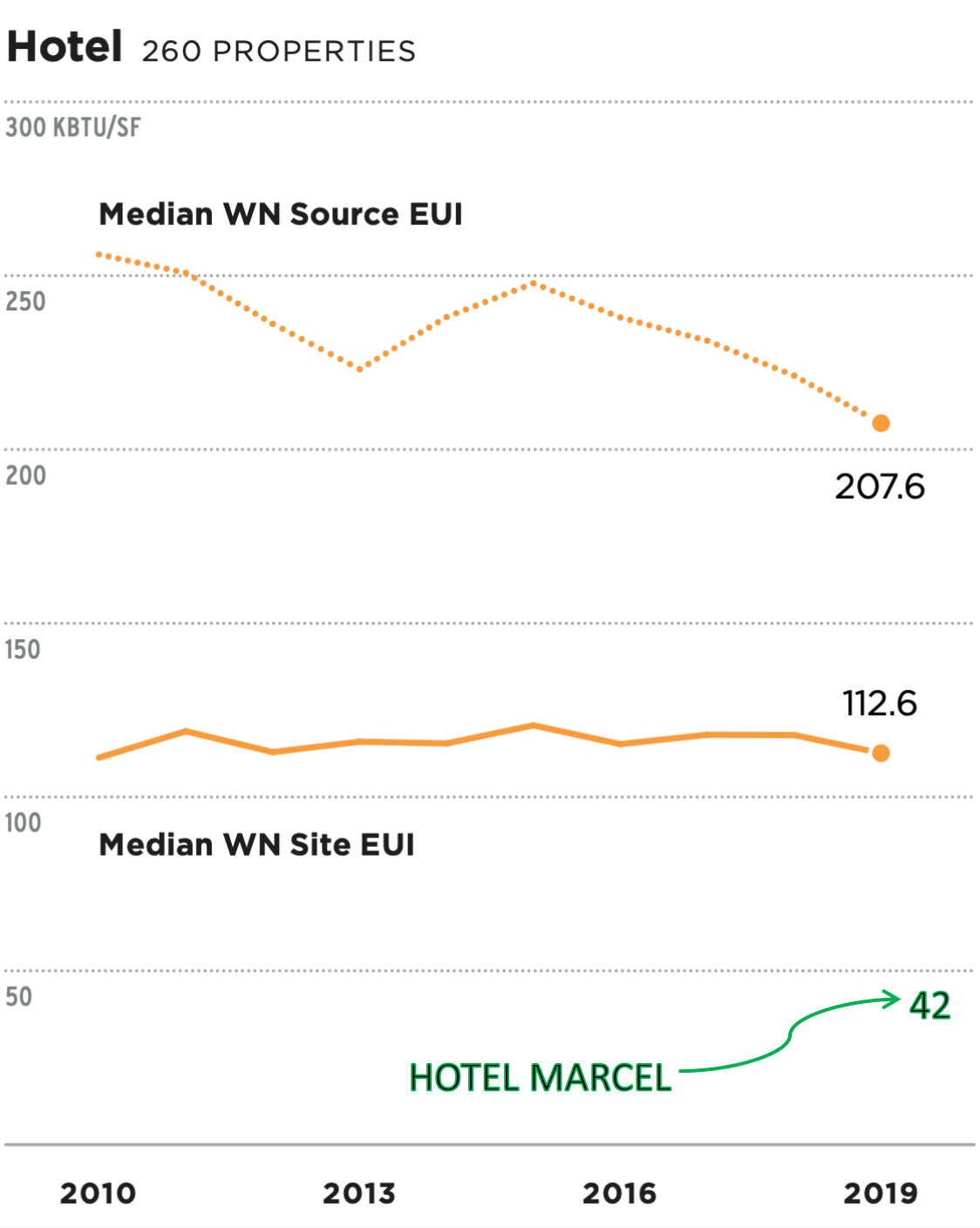
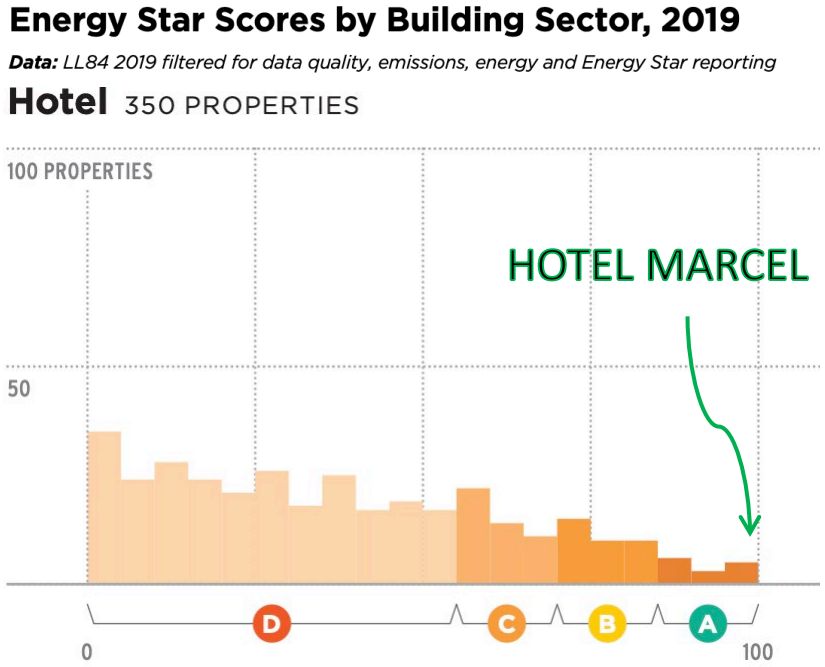
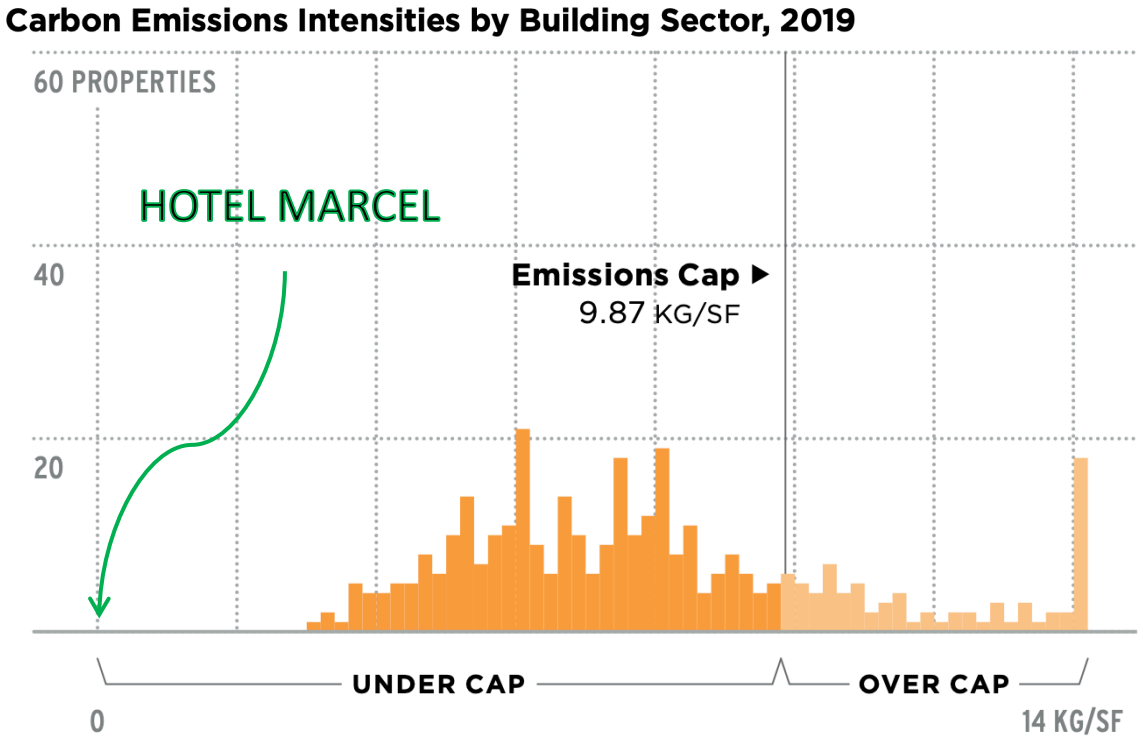

Hotel 260 PROPERTIES
300 KBTU/SF
Median WN Source EUI
250
200
207.6
150
112.6
100
Median WN Site EUI
50
42
HOTEL MARCEL
2010
2013
2016
2019


Energy Star Scores by Building Sector, 2019
Data: LL84 2019 filtered for data quality, emissions, energy and Energy Star reporting
Hotel 350 PROPERTIES
100 PROPERTIES
HOTEL MARCEL
50
D
C
B
A
0
100


Carbon Emissions Intensities by Building Sector, 2019
60 PROPERTIES
HOTEL MARCEL
40
Emissions Cap ▶
9.87 KG/SF
20
UNDER CAP
OVER CAP
0
14 KG/SF

715 Metric Tons **of Carbon Dioxide (CO_2) equivalent**

This is equivalent to greenhouse gas emissions from:

154 gasoline-powered passenger vehicles driven for one year

1,774,777 miles driven by an average gasoline-powered passenger vehicle

This is equivalent to CO_2 emissions from:

80,455 gallons of gasoline consumed

70,236 gallons of diesel consumed

791,083 pounds of coal burned

9.5 tanker trucks' worth of gasoline

This is equivalent to carbon sequestered by:

11,823 tree seedlings grown for 10 years

846 acres of U.S. forests in one year

Passive House Principles:

1. Continuous Insulation – Wrapping buildings with a thermal barrier that keeps them warm in the winter and cool in the summer

2. No Thermal Bridges – Careful detailing to avoid building building elements that allow heat or cool to bypass the thermal barrier

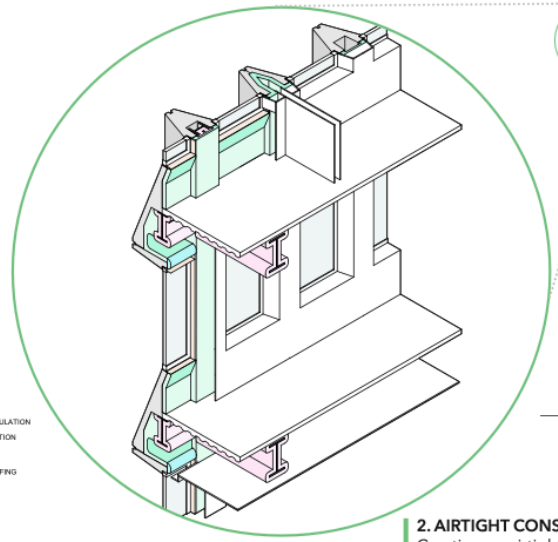
3. Airtight Construction - Creating an airtight layer that stops air from penetrating to the inside.

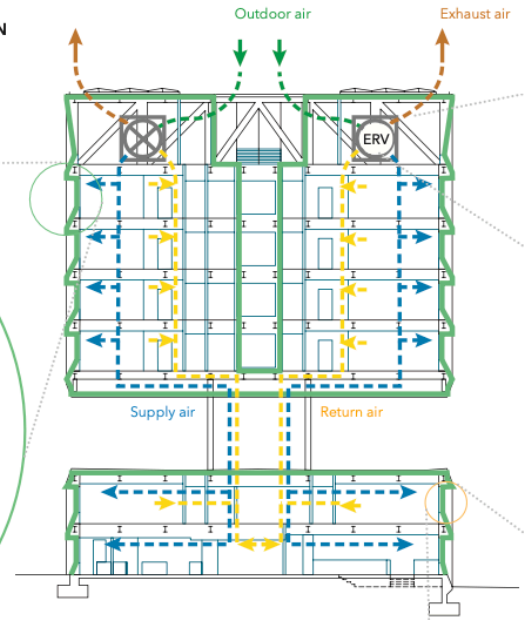
4. High Performance Windows and Doors – Airtight, thermally broken and insulated and that manage solar gain

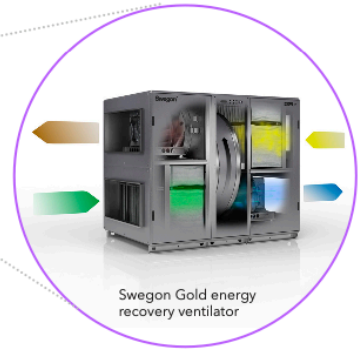
5. Fresh Air Ventilation with Heat Recovery –Providing fresh filter air for all spaces

Hotel Marcel is the first Passive House Certified Hotel in the US.

1. CONTINUOUS INSULATION
Wrapping buildings with a thermal barrier keeps them warm in winter and cool in summer

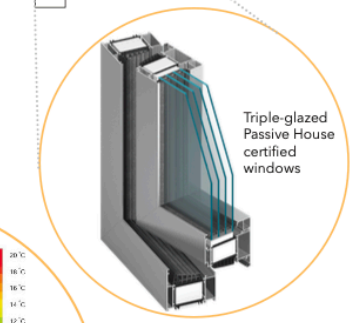




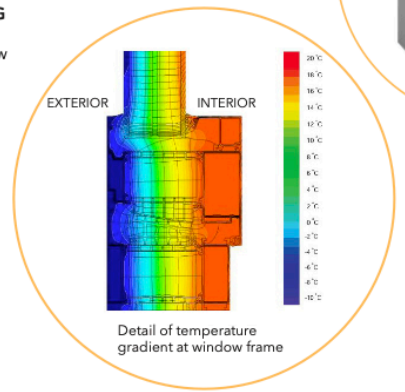


5. BALANCED VENTILATION WITH HEAT RECOVERY
Balanced ventilation with filtered fresh air for all spaces (Hotel Marcel provides 100% fresh air); enthalpy wheel pre-conditions outside air so HVAC system doesn't have to work as hard to heat or cool inside air

2. AIRTIGHT CONSTRUCTION
Creating an airtight layer stops unwanted air exchange between inside and outside



3. NO THERMAL BRIDGING
Careful detailing avoids building elements that allow heat transfer across the thermal barrier

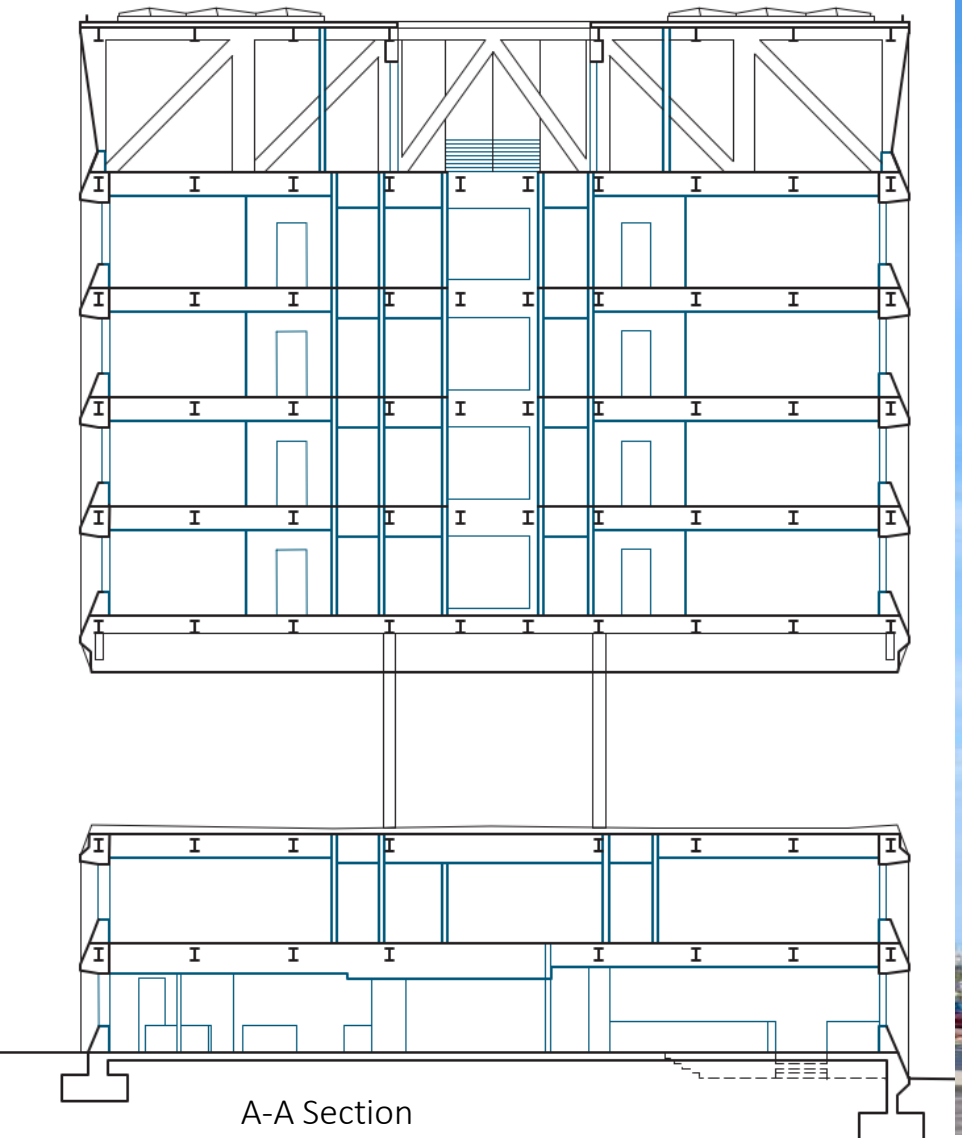


4. HIGH PERFORMANCE WINDOWS AND DOORS
Airtight, thermally broken and insulated units manage solar gain and conductive heat transfer

FOLLOWING **PASSIVE HOUSE PRINCIPLES** RESULTS IN BUILDINGS THAT ARE COMFORTABLE AND USE **ABOUT 75% LESS ENERGY** COMPARED TO TYPICAL NEW CONSTRUCTION.

HOTEL MARCEL WAS CERTIFIED BY THE PASSIVE HOUSE INSTITUTE (PHI) to meet its EnerPHit standards for high-performance retrofits. To view more metrics on Hotel Marcel's Passive House envelope and other systems, scan the QR code below.

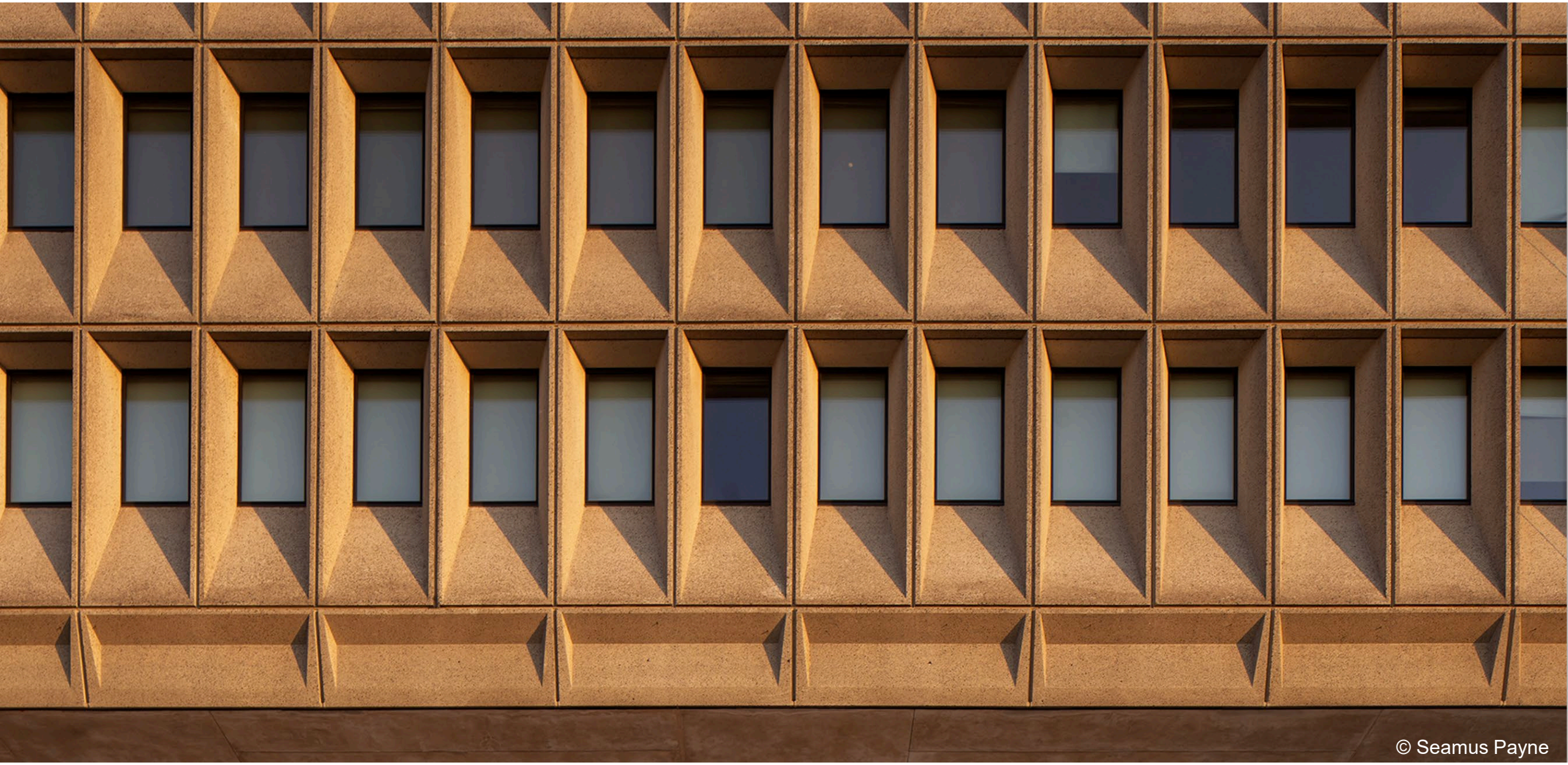
SECTION



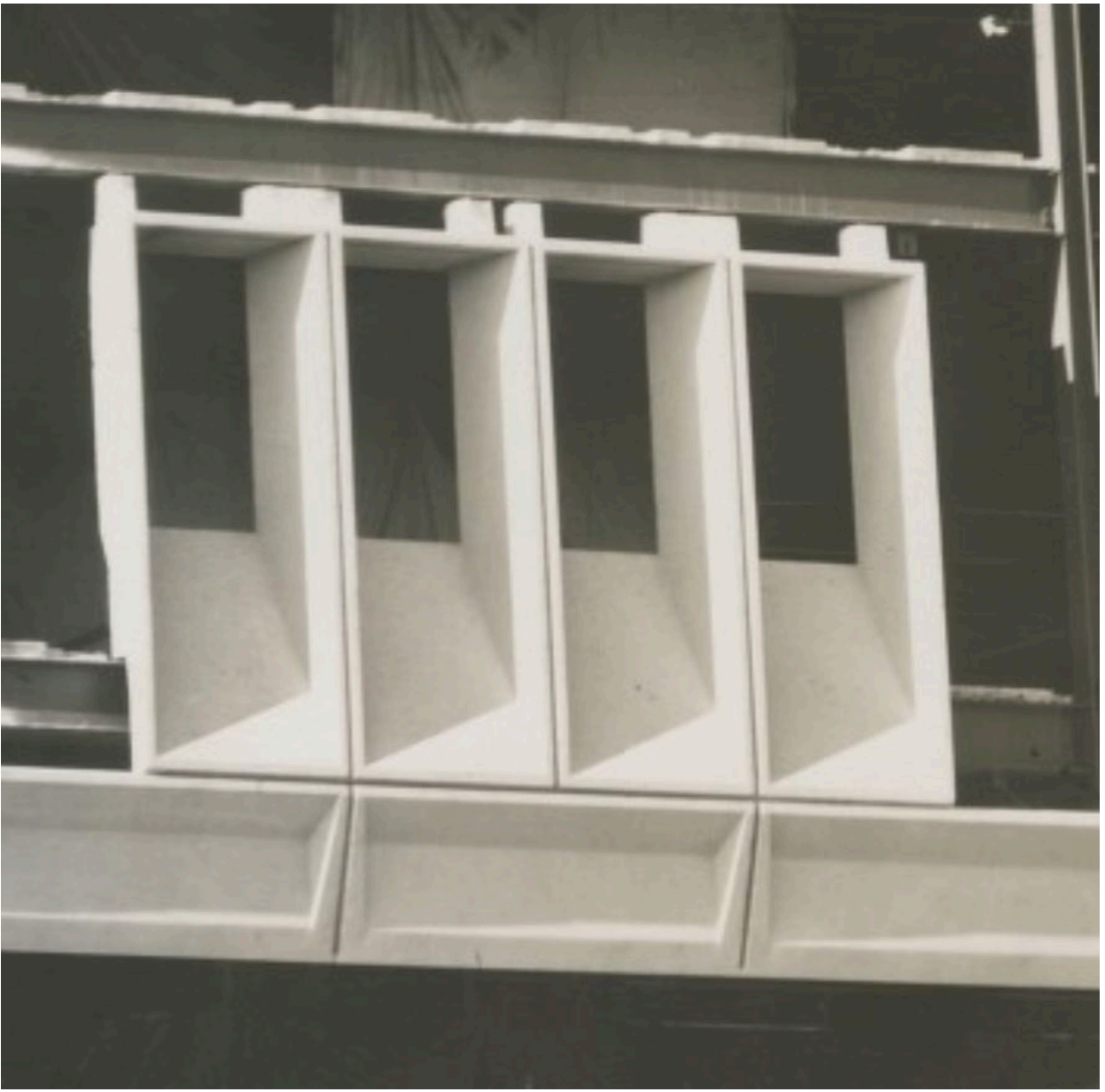
A-A Section
© Becker + Becker Architects

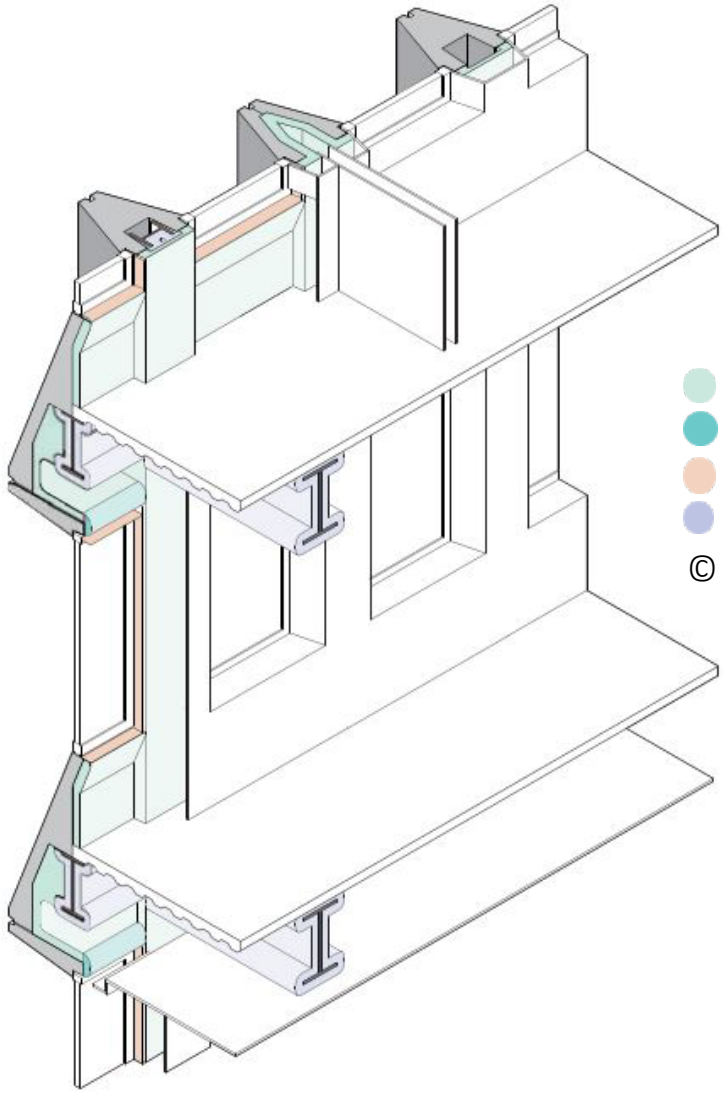
Concrete façade is being reconditioned © Zach Pontz

THERMAL ENVELOPE



FACADE BUILD-UP

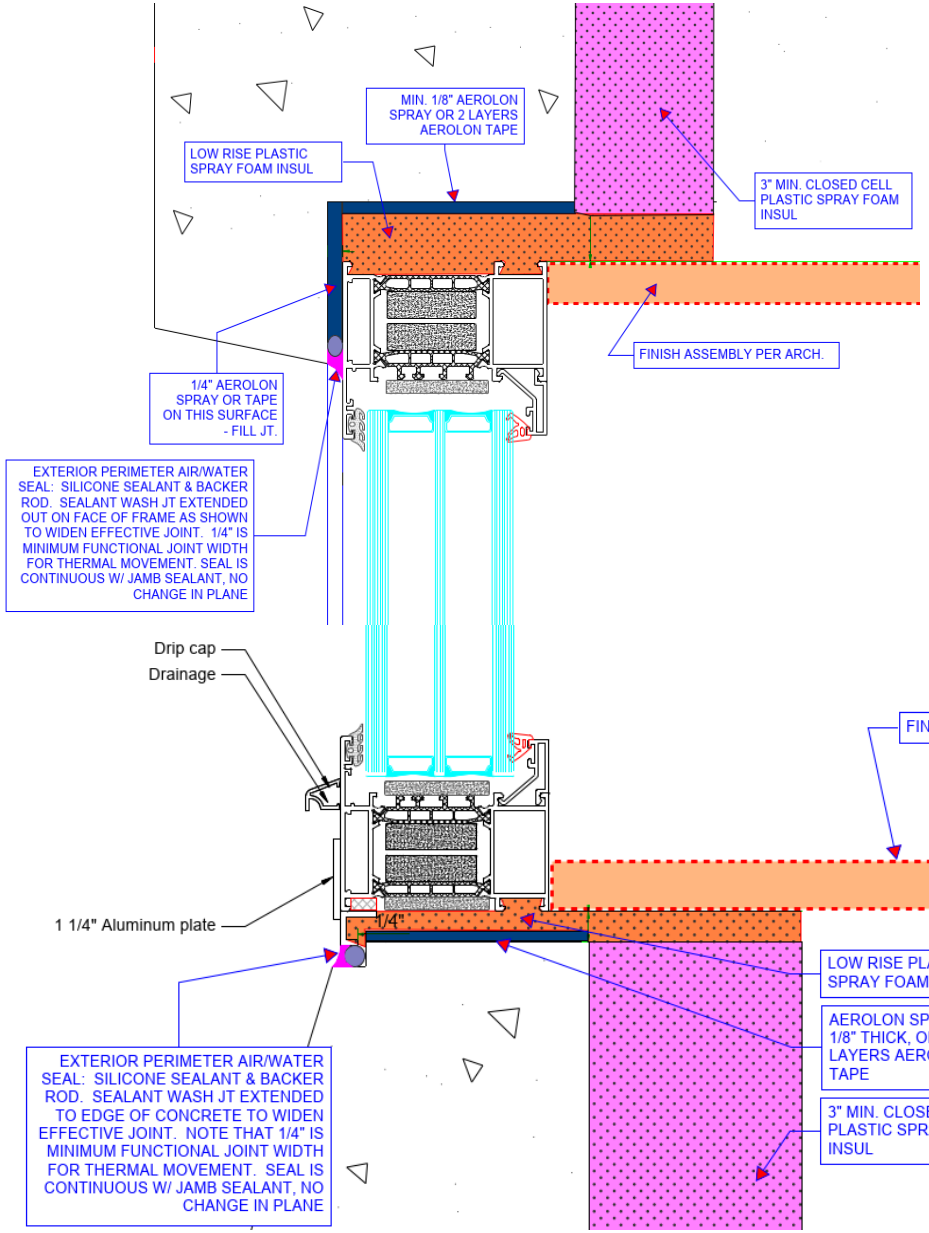




- Closed cell PUR foam
- Open cell PUR foam
- Aerogel insulaton
- Fireproof coatig

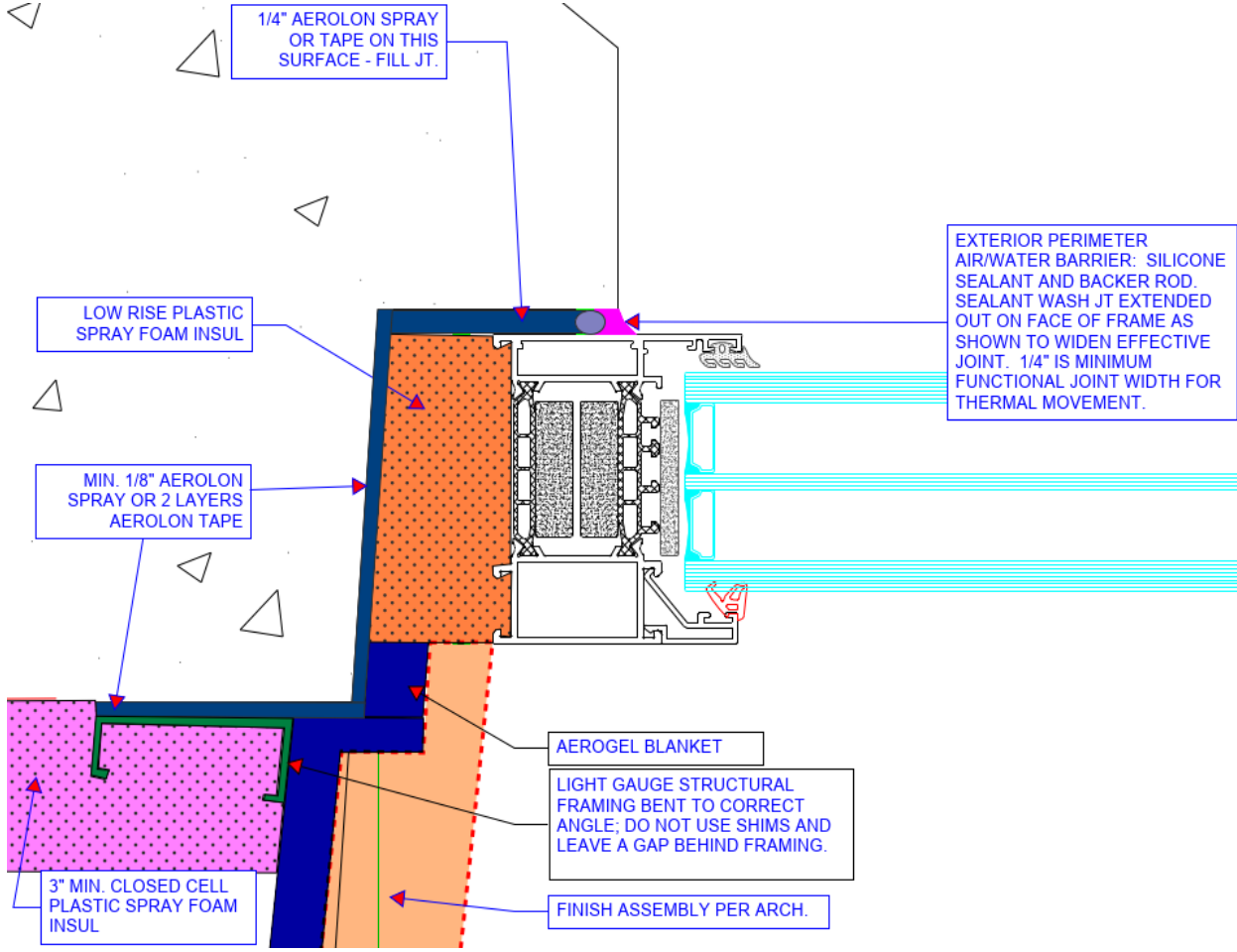
Axonometric illustration of the prefabricated façade with new thermal insulation materials.

WINDOW DETAILS



Window top install detail

© Steven Winter Associates



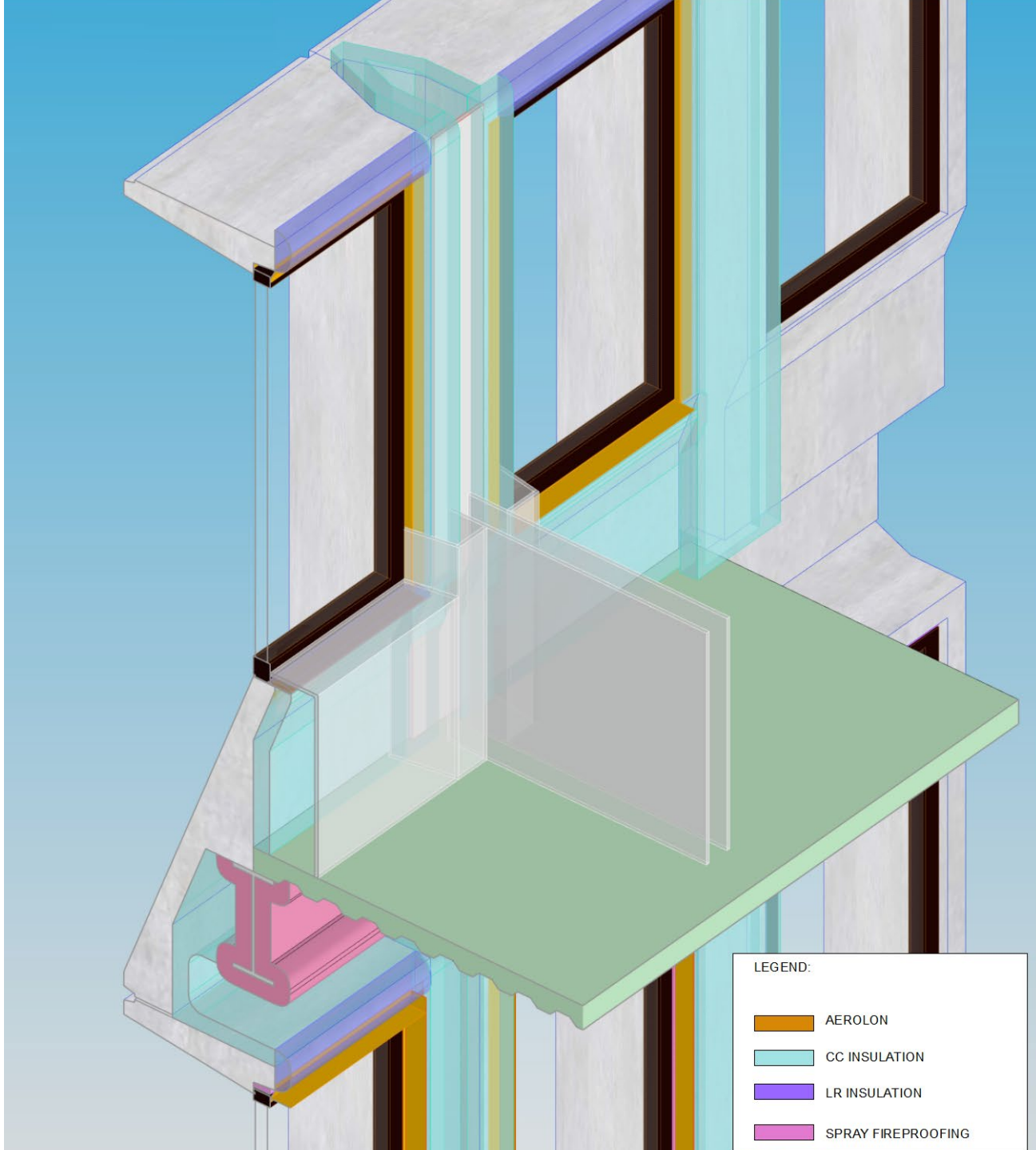
Window bottom install detail

© Steven Winter Associates

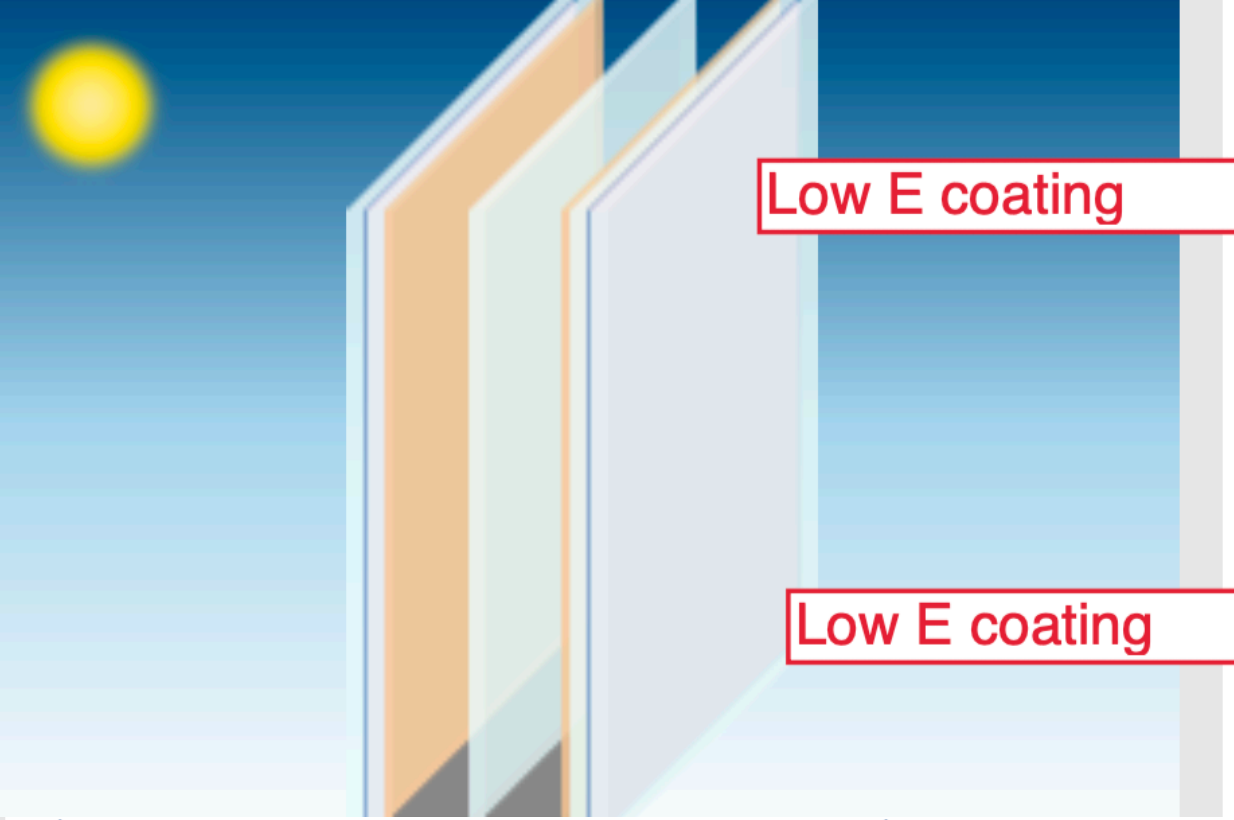
Window lateral install detail, © Steven Winter Associates

Probable Energy Use and Utility Cost:

	1. Proposed Model	
	Electricity (kWh)	Natural Gas Therm
Heating	73,467	-
Cooling	89,157	-
Interior Lighting	119,293	-
Exterior Lights	19,636	-
Interior Equipment	356,251	-
Exterior Equipment	-	-
Fans	94,023	-
Pumps	0	-
Heat Rejection	-	-
Humidification	-	-
Heat Recovery	-	-
Water Systems	49,195	-
Refrigeration	-	-
Generators	-	-
Total End Uses	801,023	-
Utility Cost	$ 87,024	$ -
Total		$ 87,024



WINDOWS INSTALL



Low E coating	Pane 1
	PLANICLEAR (4 mm)
	PVB silence (1 x 0,38 mm)
	PLANICLEAR (4 mm)
	PLANITHERM XN
	Cavity 1
	ARGON (90%) / AIR (10%) / 18 mm
	Pane 2
	PLANICLEAR (4 mm)
	Cavity 2
	ARGON (90%) / AIR (10%) / 18 mm
Low E coating	Pane 3
	PLANITHERM XN
	PLANICLEAR (4 mm)
	PVB silence (1 x 0,38 mm)
	PLANICLEAR (4 mm)

LUMINOUS FACTORS

CIE (15-2004)

Light transmission (TL %)	72,0 %
Outdoor reflection (RLe %)	14,0 %
Indoor (RLi %)	14,0 %

SOLAR FACTORS

NFRC

SHGC	0,4451
RHG	326,82 W/m²
Shading Coefficient (SC)	0,5116

COLOR RENDERING

CIE (15-2004)

Transmission (Ra)	95,3
Reflection (Ra)	93,3

ENERGY FACTORS

NFRC

Transmission (Te)	40,4 %
Reflection (Ree)	28,2 %
Indoor (Rei)	28,2 %
Absorption (AE1)	21,8 %
Absorption (AE2)	3,5 %
Absorption (AE3)	6,1 %

THERMAL TRANSMISSION

NFRC100

Ug - Winter	0,724 W/m².K
Ug - Summer	0,578 W/m².K

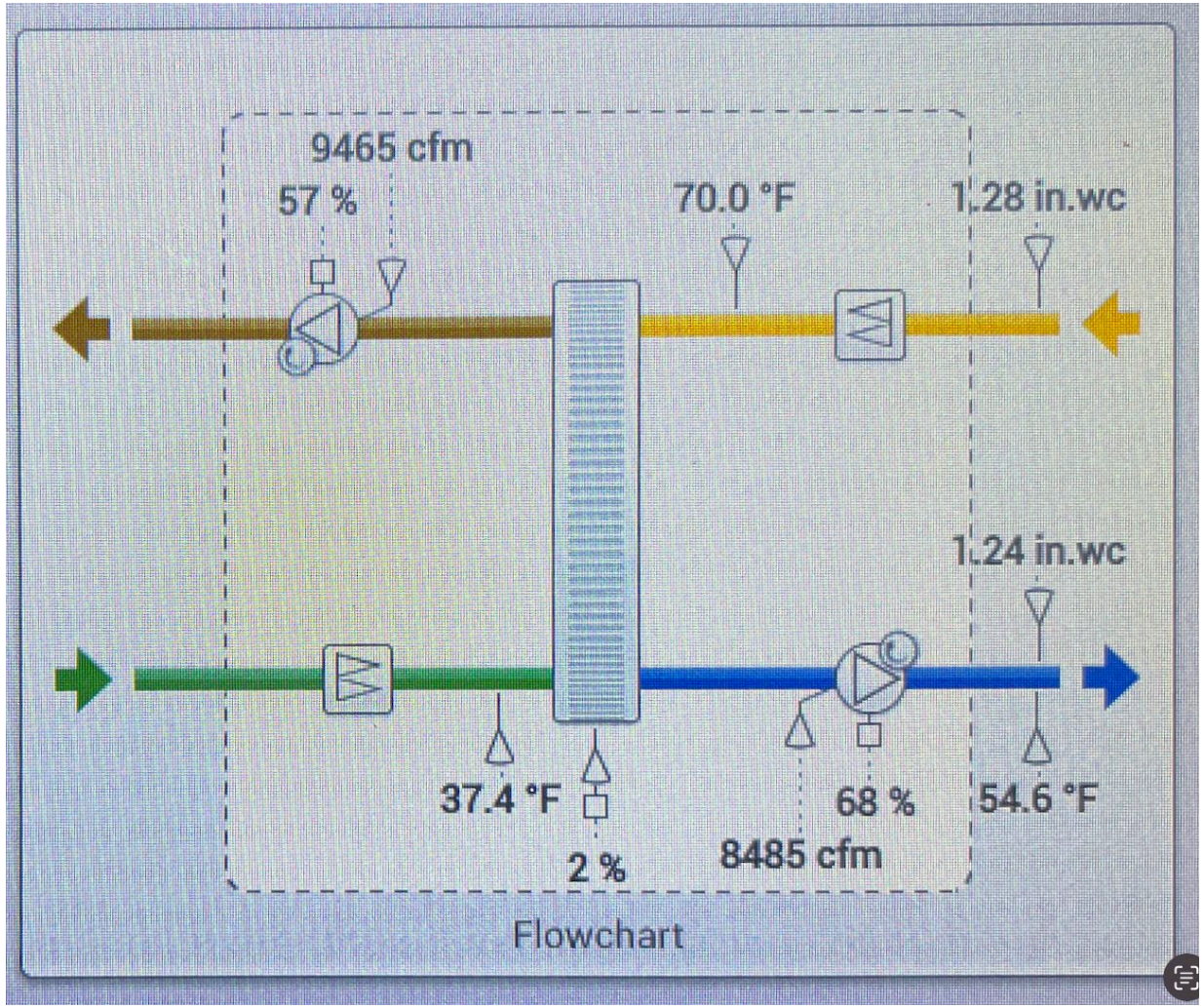
0° related to vertical position

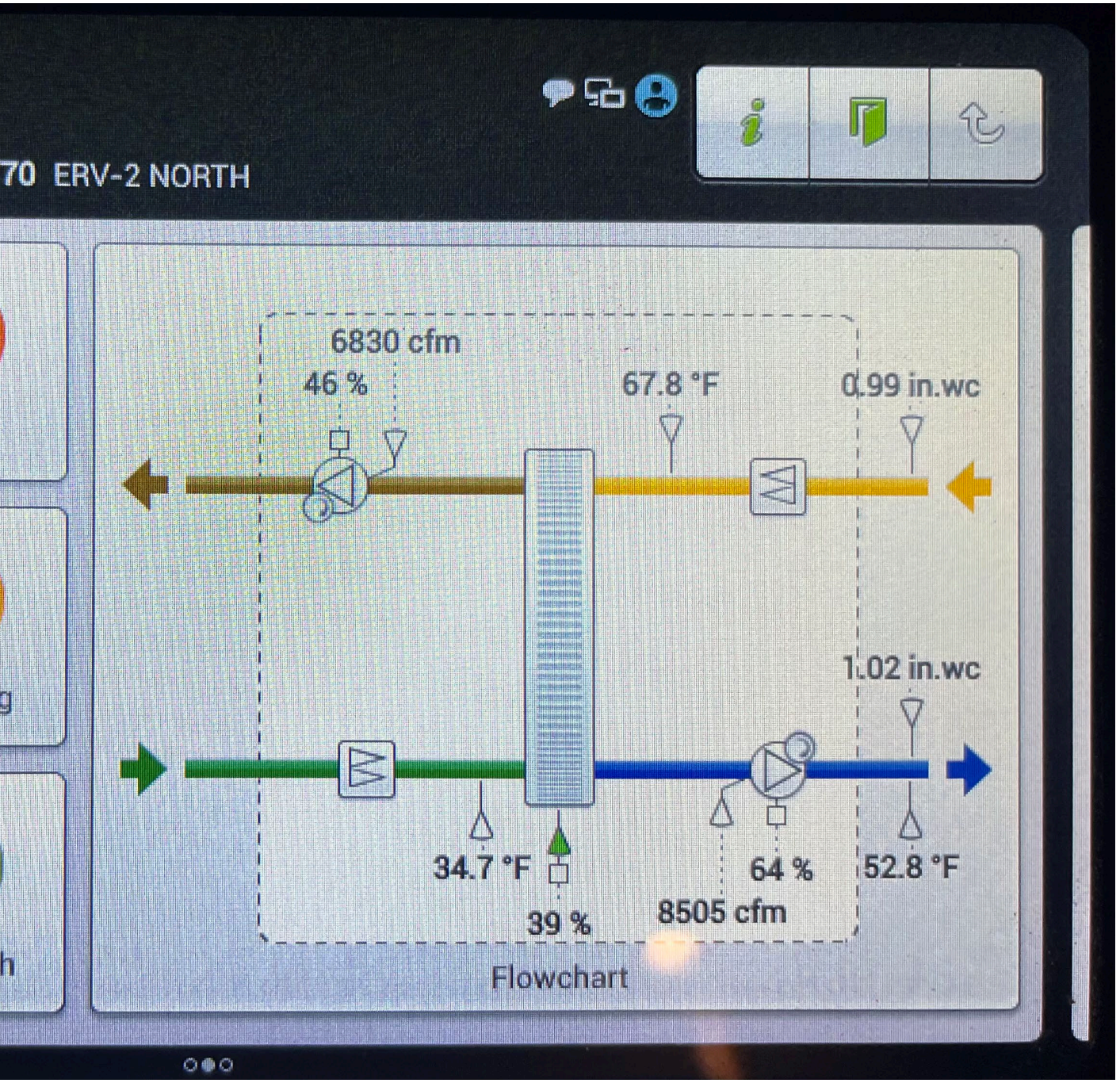
ACOUSTICS

EN12758

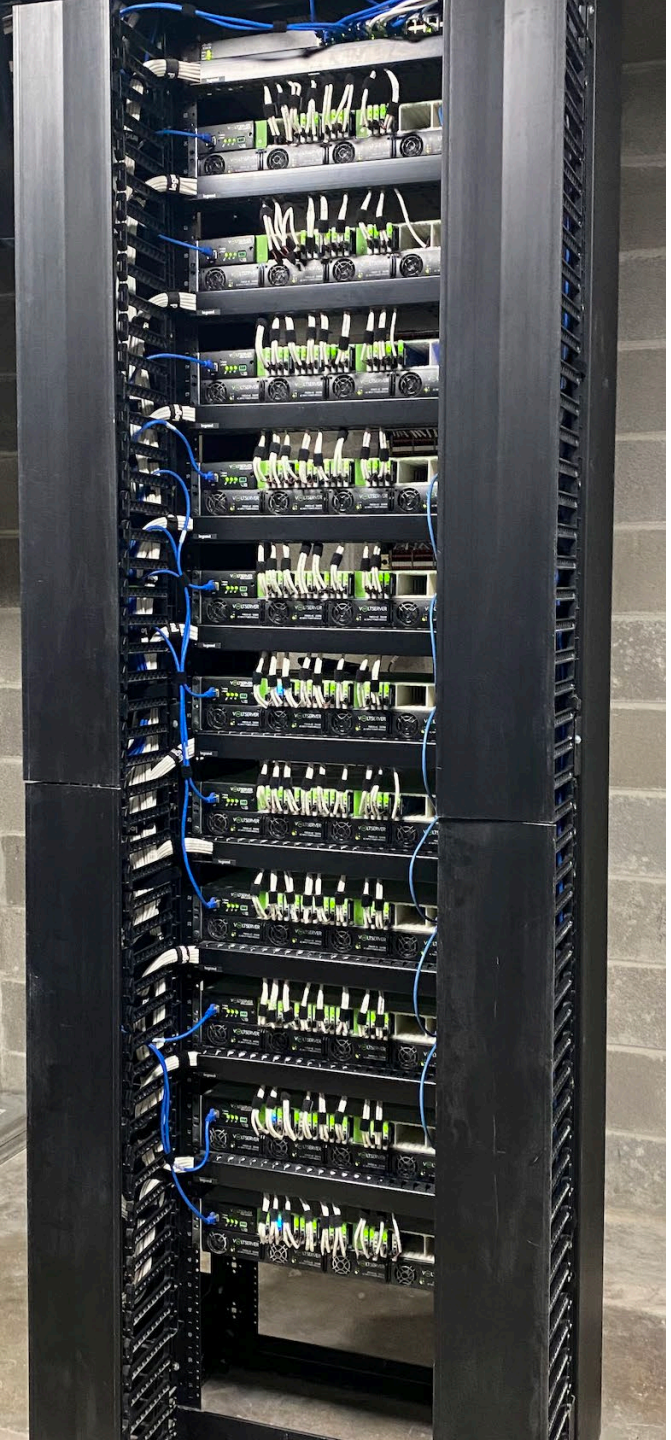
Acoustic simulated values	Rw(C;Ctr) = 47(-2;-7) dB

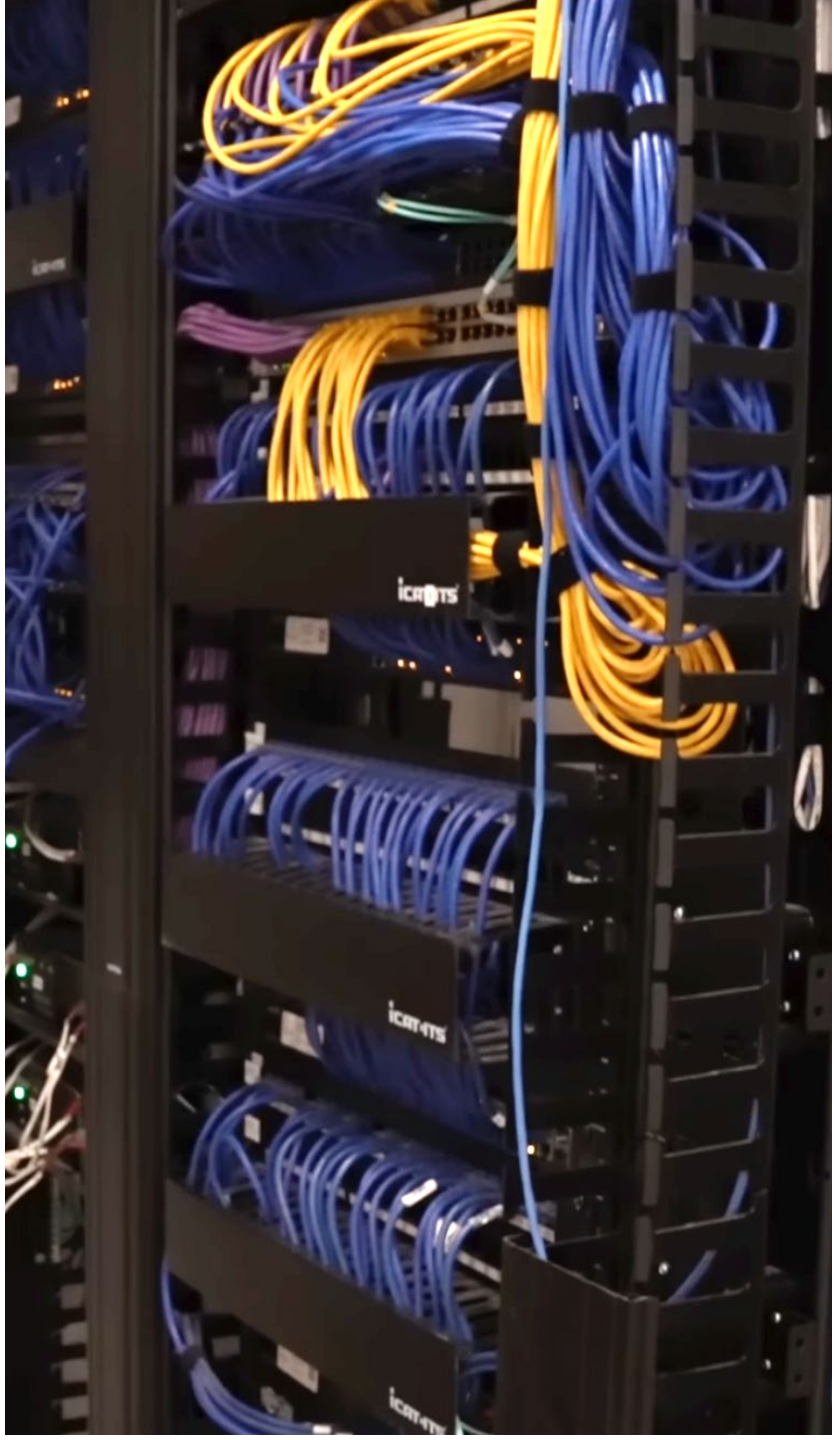
ENERGY RECOVERY VENTILATORS



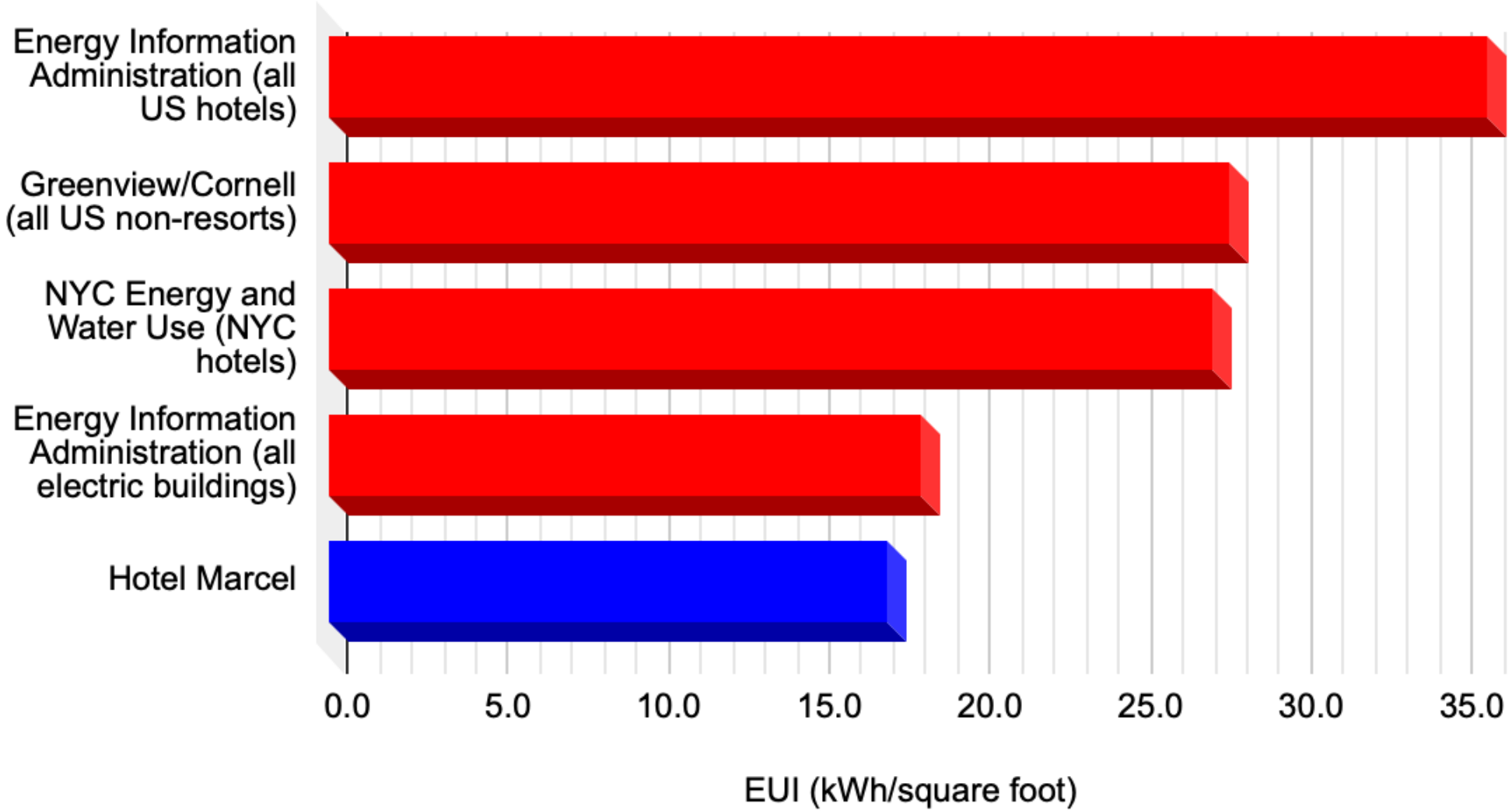

70 ERV-2 NORTH
6830 cfm
46 %
67.8 °F
0.99 in.wc
1.02 in.wc
34.7 °F
39 %
8505 cfm
64 %
52.8 °F
Flowchart

HVAC CONTROLS





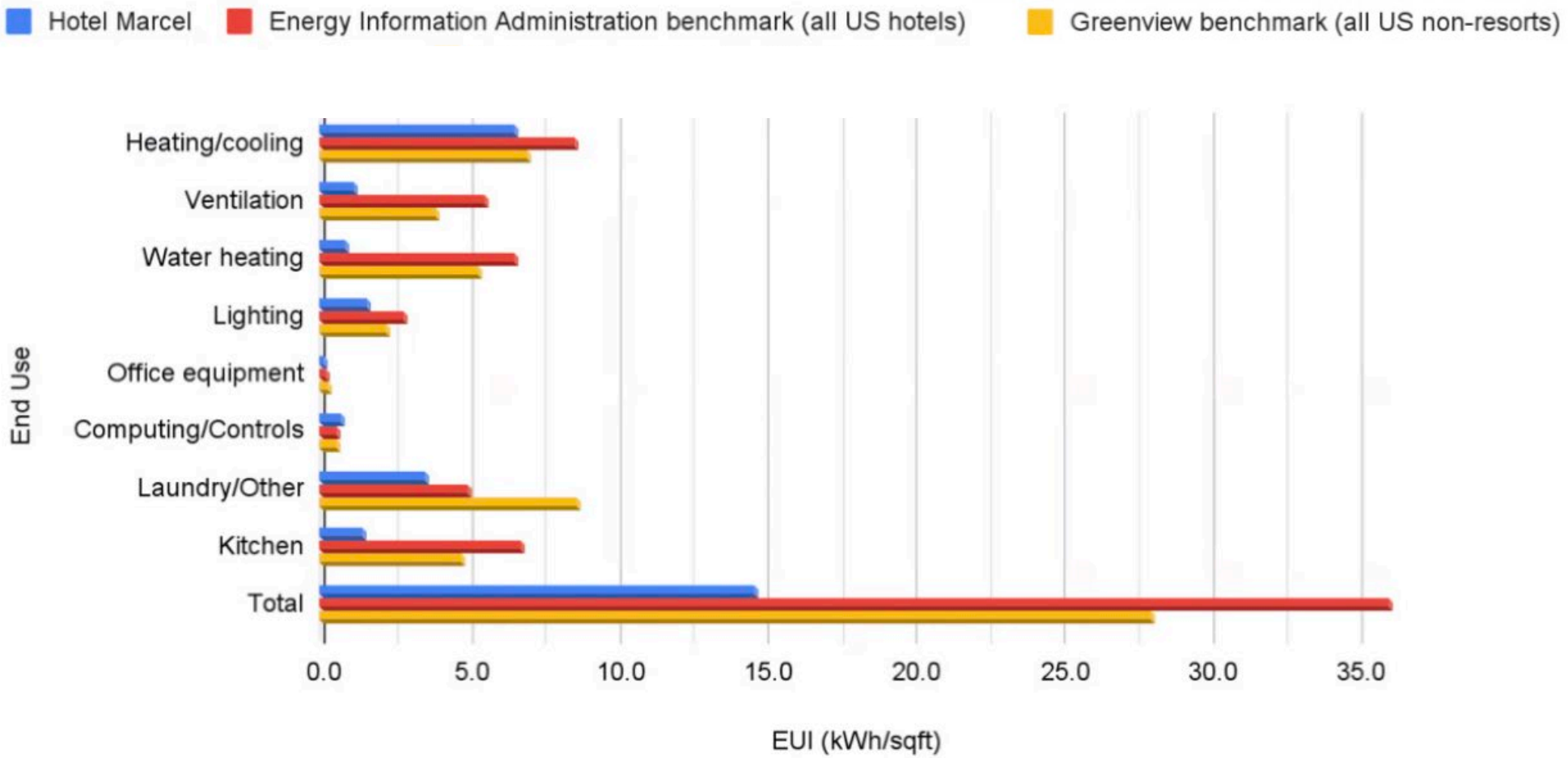
Mean Site EUI of Hotel Marcel vs. Industry Benchmarks



Sources: *EIA Commercial Buildings Energy Survey 2022*
Cornell Hotel Sustainability Benchmarking 2023
NYC Energy and Water Use Report 2020

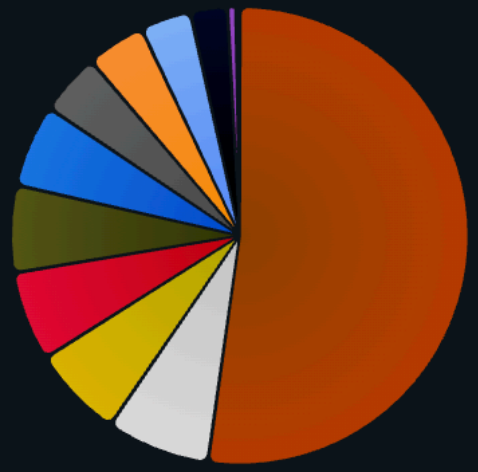
HOTEL MARCEL **USES LESS THAN HALF THE ENERGY** A TYPICAL HOTEL DOES FOR ITS BUILDING OPERATIONS.

MEAN SITE EUI BY END USE
HOTEL MARCEL VS INDUSTRY BENCHMARKS



Hotel Marcel's Energy Use Metering and Dashboard

Total energy consumption over time period



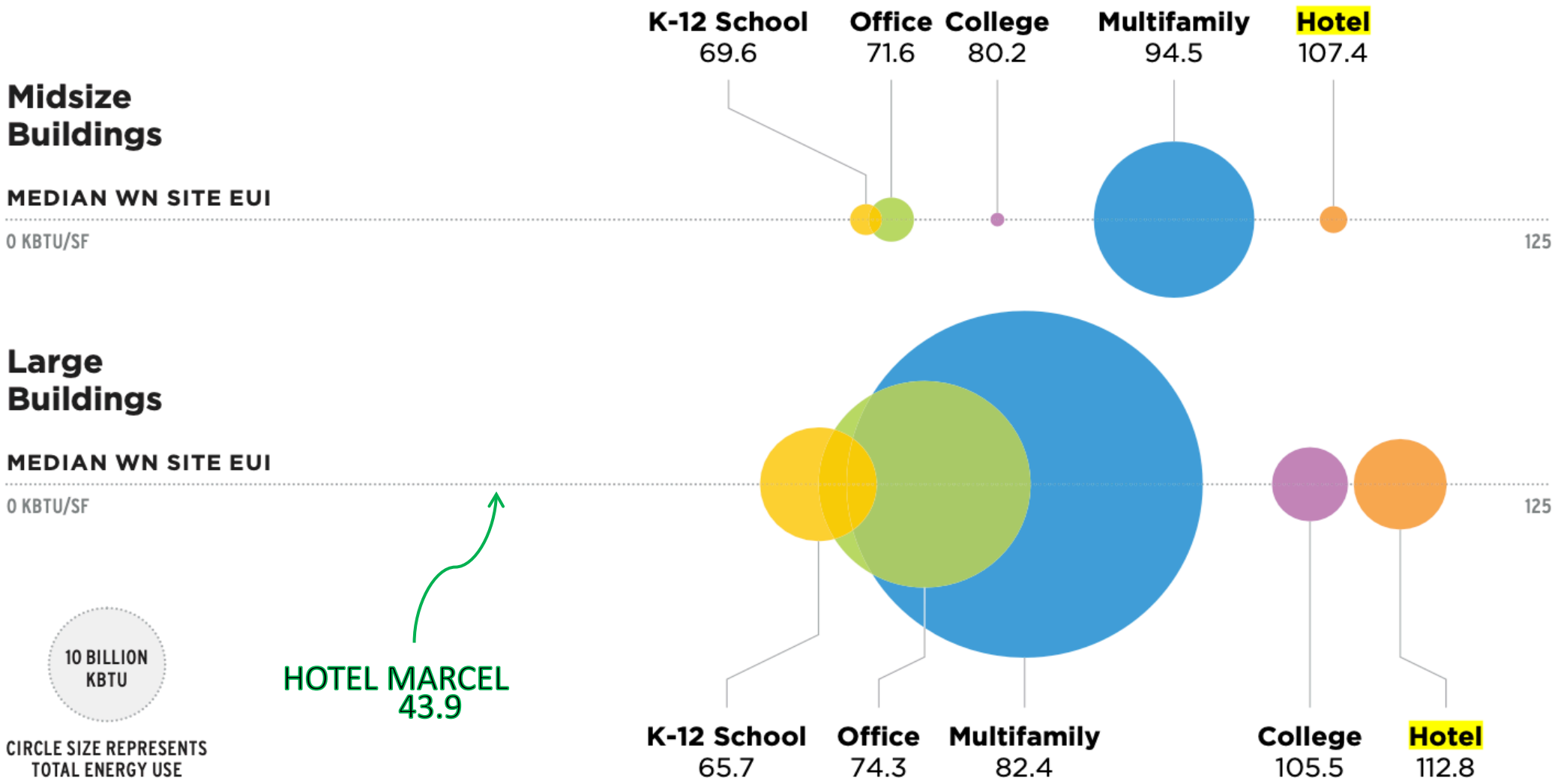
	Value
Area and room heating and cooling	1.72 MWh
Indoor Lighting	240 kWh
Kitchen	213 kWh
Domestic Hot Water	207 kWh
Laundry	201 kWh
Guest Rooms	191 kWh
Emergency Power	142 kWh
Central heating and cooling	135 kWh
1st Floor	116 kWh
9th Floor	83.5 kWh
Elevators	17.4 kWh
ERVs	5.96 kWh

Real-time power by end use

FIGURE 5

Total Site Energy Use and Intensity by Building Sector, 2019

Data: *LL84 2019 filtered for data quality, emissions, energy and property type; N = 18,039*



RENEWABLES

ENERGY STORAGE SYSTEM


HOTEL
MARCEL

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