



**BUILDING
PERFORMANCE.
CONNECTED.**



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WHAT IS SUSTAINABLE DEVELOPMENT?

ACADEMIC

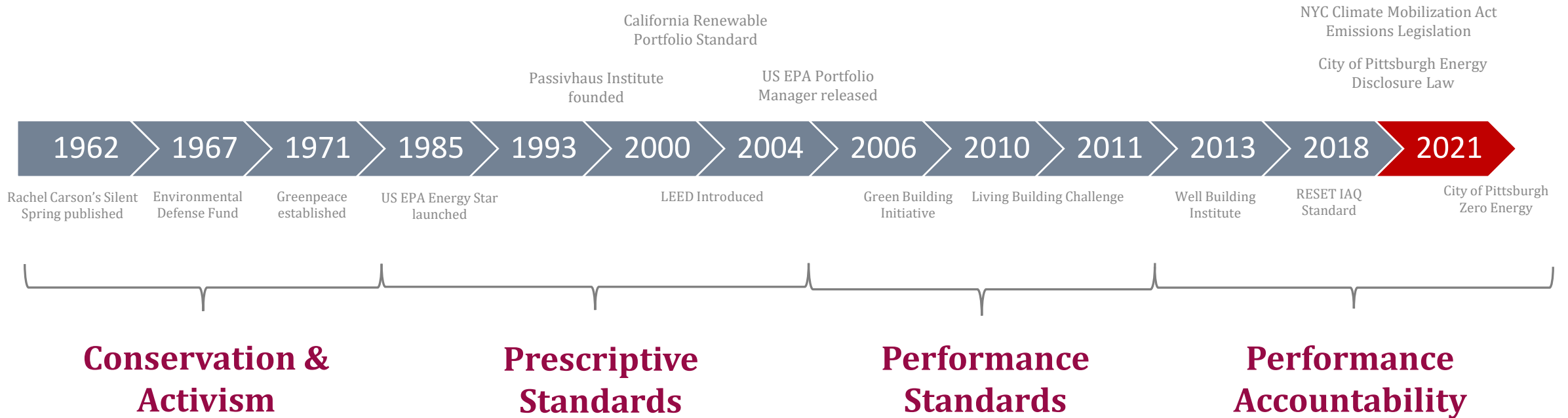


SOCIO-POLITICAL



HISTORY OF SUSTAINABILITY

Owners, Developers and Funders are looking for proof.



“Dream It”

“Think It”

“Prove It”

“Defend It”

WHAT IS ENERGY USE INTENSITY?

TOTAL ANNUAL
ENERGY
USE



(kBtu)



Just as a car's fuel efficiency is calculated in miles per gallon and a baseball pitcher's performance measured using earned run average, a building can employ energy use intensity (EUI) and water use intensity (WUI) as performance metrics.



BUILDING
AREA
SQUARE FEET



EUI
kBtu / sqft
PER YEAR




Owner's Project Requirements

ESTABLISH TARGET VALUES

- Carbon
- Zero Energy
- Indoor Air Quality
- Social Equity
- Data Control & Transparency

January 25, 2021



AUROS GROUP OWNER'S PROJECT REQUIREMENTS FIFTH AND DINWIDDIE, WEST SITE

Fifth and Dinwiddie Development, LLC
Fifth and Dinwiddie West, Pittsburgh, Pennsylvania
192,000 Square Feet
Multi-Family, Retail
\$38 million
55 kBtu/sf/yr
Derrick Tillman
Craig Stevenson

Building Owner
Building Address
Building Size
Building Type
Project Budget
CBECs Site EUI
Owner Sustainability Director
AUROS360™ Advisor

Building Address
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Targets & Goals	Responsibility	Notes
SUSTAINABILITY PROGRAM GOALS		
Passive House (PHI) Classic Standard (certification)	AUROS Group	currently anticipate a generator unless ownership wants for a specific use. To discuss costs & complexity associated with integrating PV system into entrance with meterbanks for individual tenant meters
RESET Air (certification)	AUROS Group	
Fitwel (certification)	AUROS Group	
C-PACE (compliance)	Derrick Tillman	Heating (Winter); 75F Cooling (Summer) PHI - 65F Heating (Winter); 75F Cooling (Summer) Saving humidity levels while providing ventilation (even with energy wheels) will be challenging. (the dehumidifying design is 91.4DB/78.6WB - design is 100.4DB/74.5WB for Dallas)
p4 Performance Measures (narrative only)	GBBN	
The 2030 Challenge (compliance)	AUROS Group	Saving humidity levels while providing ventilation (even with energy wheels) will be challenging. (the dehumidifying design is 91.4DB/78.6WB - design is 100.4DB/74.5WB for Dallas)
MEASUREMENT AND VERIFICATION		
Integrated Solutions includes: - AIA 2030 District Whole-Building Analytics - RESET Air Accredited Data Provider - Interrogation-based Commissioning - Monitoring-based Commissioning - Single-Pane of Glass for all Operational Networks	MBI AUROS Group Newcomb & Boyd	Occupant Survey for Wi-Fi Access and Tenant Exit Interview Management AUROS Group
Converged Network, Open-Integration Data Platform and DDC System		Occupant Survey for Regular Occupants (Fitwel) AUROS Group
Optimal Solar Integration	Derrick Tillman Derrick Tillman Derrick Tillman Derrick Tillman Derrick Tillman/NDC Asset	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
20% Affordable	Derrick Tillman	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
Public Plaza Space	Derrick Tillman	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
25% to MBEs and 10% to WBEs	Derrick Tillman	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
25% to Minority and 10% to Women	Derrick Tillman	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
Qualitative Health and Development	AUROS Group	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
Social Equity and Inclusion	AUROS Group	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
Workforce Training and Education	Derrick Tillman	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
RENEWABLES	Derrick Tillman	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
14-20 kBtu/sf/yr	AUROS Group	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
Optimal Solar	MBI	Occupant Survey for Regular Occupants (Fitwel) AUROS Group
INDOOR AIR QUALITY		
Use Natural Materials - Low/No Maintenance	DBIFitzGerald	Possible solutions: Trinity River trail, landscaping amenities, garden space, community inclusion
Biophilia	DBIFitzGerald	Pending review
MATERIALS	DBIFitzGerald	Pending review
Material Toxicity	DBIFitzGerald	Pending review
Material Embodied Energy	DBIFitzGerald	Pending review
MECHANICAL AND HVAC		
Cooling	4.75 kBtu/sf/yr, Annual Cooling Demand 3.61 Btu/sf/yr, Peak Cooling Load 4.75 kBtu/sf/yr, Annual Heat Demand 3.17 Btu/sf/yr, Peak Heat Load	TBD - Established by PHI TBD - Established by PHI Established by PHI Established by PHI Established by PHI
Heat	75% heat recovery efficiency 0.76 W/ftm cfm/sf of Floor Area & cfm/person, Design Flow	V3 V3 V3 V3 V3
Ventilation	Heat/Energy Recovery Strategy	V3
MEASUREMENT AND VERIFICATION		
Operational Technologies (OT)	Open-Integration v. Proprietary OT Systems Single-Pane of Glass for all Operational Network Data Utility Meters	V3/AUROS Group AUROS Group V3/AUROS Group



Owner's Project Requirements

TARGET VALUES (excerpt)

KEY PERFORMANCE INDICATORS

METRICS

KEY PERFORMANCE INDICATORS	METRICS
<u>SUSTAINABILITY CERTIFICATION PROGRAM GOALS</u>	Evidence-based goals <i>[Select your programs]</i>
<u>ENERGY</u>	
Site Energy Use Intensity (EUI)	14 kBtu/sf/yr
Gas v. Electrification Balance	
Renewables	Offset annual energy consumption to Zero Energy
Building Envelope Infiltration	0.05 cfm/gross sf shell @50Pa
<u>INDOOR AIR QUALITY</u>	
Particulate Matter 2.5 (PM2.5)	< 12 µg/m ³
Total Volatile Organic Compound (TVOC)	< 0.4 mg/m ³ (< 400 µg/m ³)
Carbon Dioxide (CO ₂)	< 600 ppm
Temperature	Monitored
Humidity	Monitored
Carbon Monoxide (CO)	< 9 ppm
Ozone (O ₃)	< 51 ppb
Particulate Matter 10 (PM10)	< 50 µg/m ³
Radon	< 0.148 Bq/L [4 pCi/L] in the lowest occupied level
Ventilation Rate:	PH Compliance

ENVELOPE = CONTROL YOUR ENVIRONMENT



Passive First = Energy; RESET Air = IAQ

RESET Air ECOSYSTEM

Interconnected with third-party safeguards



1. RESET® Monitor Standards



R BUILDING GRADE
ACCREDITED MONITOR



2. RESET® Installation & Maintenance Standards



RESET AP

RESET Accredited Professionals (AP) are independent professionals trained to guide projects from design to deployment.



3. RESET® Data Communication Standards



The RESET cloud collects data from accredited project networks and sub-clouds, analyses the data and reports the result.

RESET Air Parameters

Best practices for Continuous Air Quality Monitoring

PM

PARTICULATE MATTER

C / F

TEMPERATURE

VOC

VOLATILE ORGANIC COMPOUNDS

RH

RELATIVE HUMIDITY

CO₂

CARBON DIOXIDE

CO

CARBON MONOXIDE



Battle for the Envelope

NATURAL ORDER OF SUSTAINABILITY

Resilience

ENVELOPE FIRST
PASSIVE OVER ACTIVE
SITE OVER SOURCE

- Passive First
- Active Second
- Renewables Last

A SIMPLE IDEA

Comfort Drives Performance

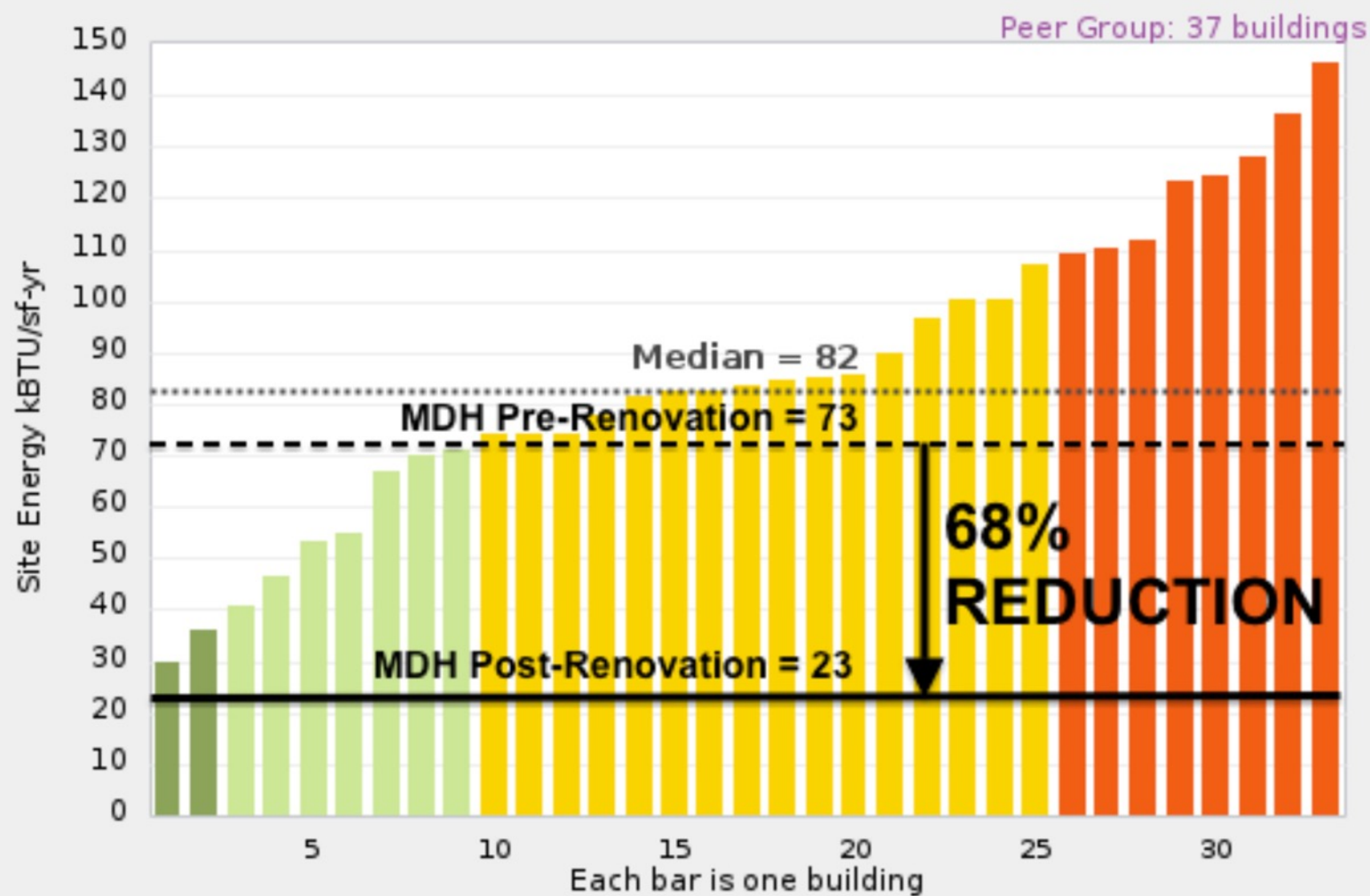


Whole Building - Total Site Energy (kBTU/sf-yr)

View



Axis Label ▾ Units ▾



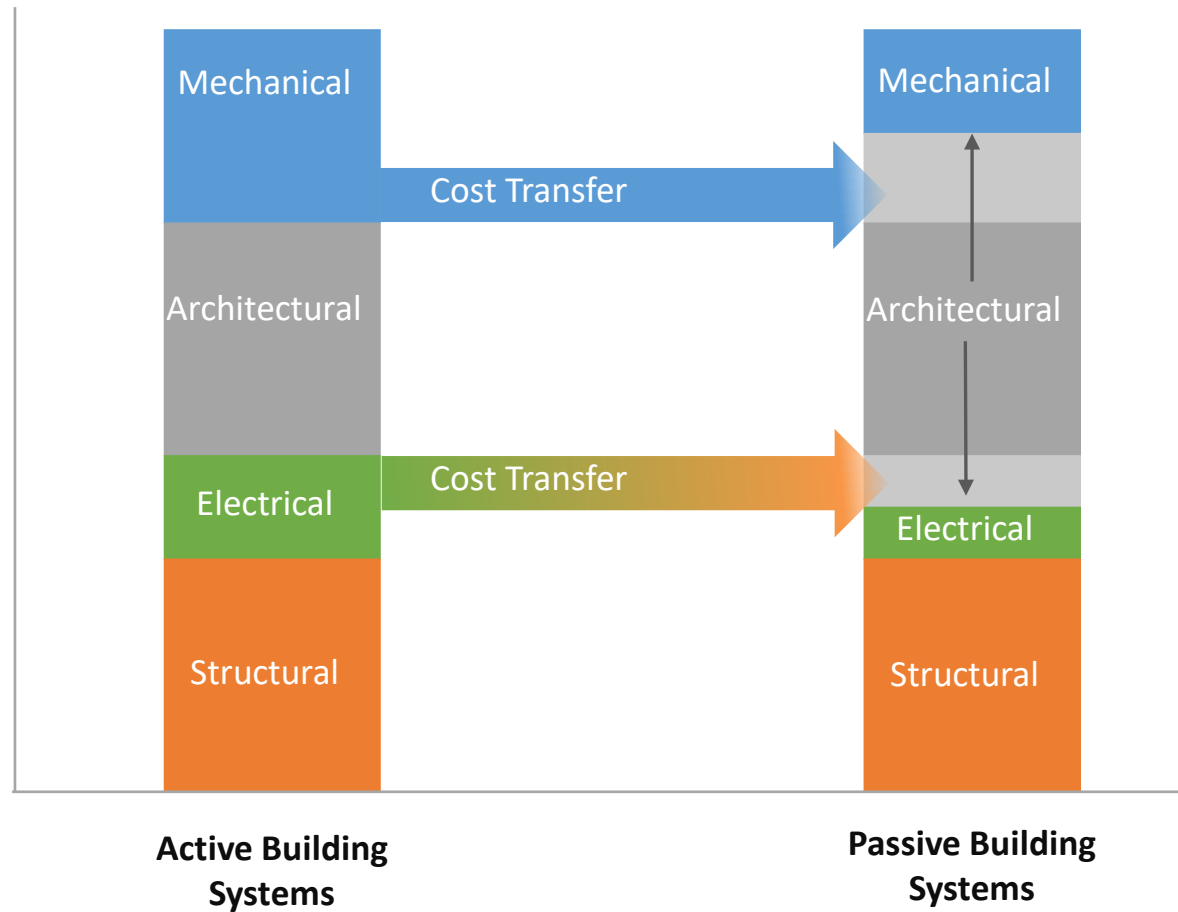
5-25%-ile 25-50%-ile 50-75%-ile 75-95%-ile



Source: "How a PA affordable housing agency is making ultra-efficient buildings mainstream" Pittsburgh Post-Gazette December 31, 2018 & Pennsylvania Housing Finance Agency (PHFA)
 Note: Low-income housing tax credits were not awarded in 2017.

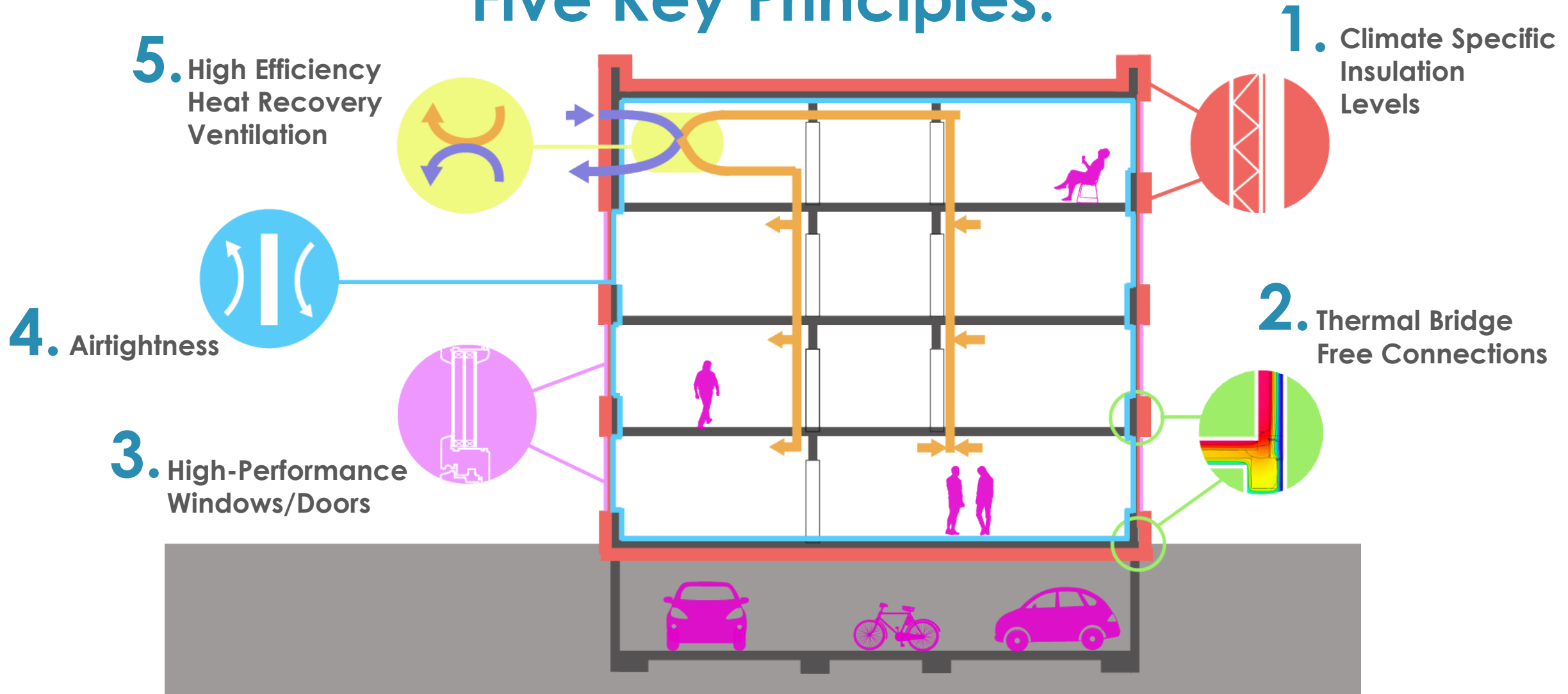
Passive Building Costs Less With Experience

COSTS MIGRATE WITH PASSIVE APPROACH



INTEGRATED METHODOLOGY

Five Key Principles:

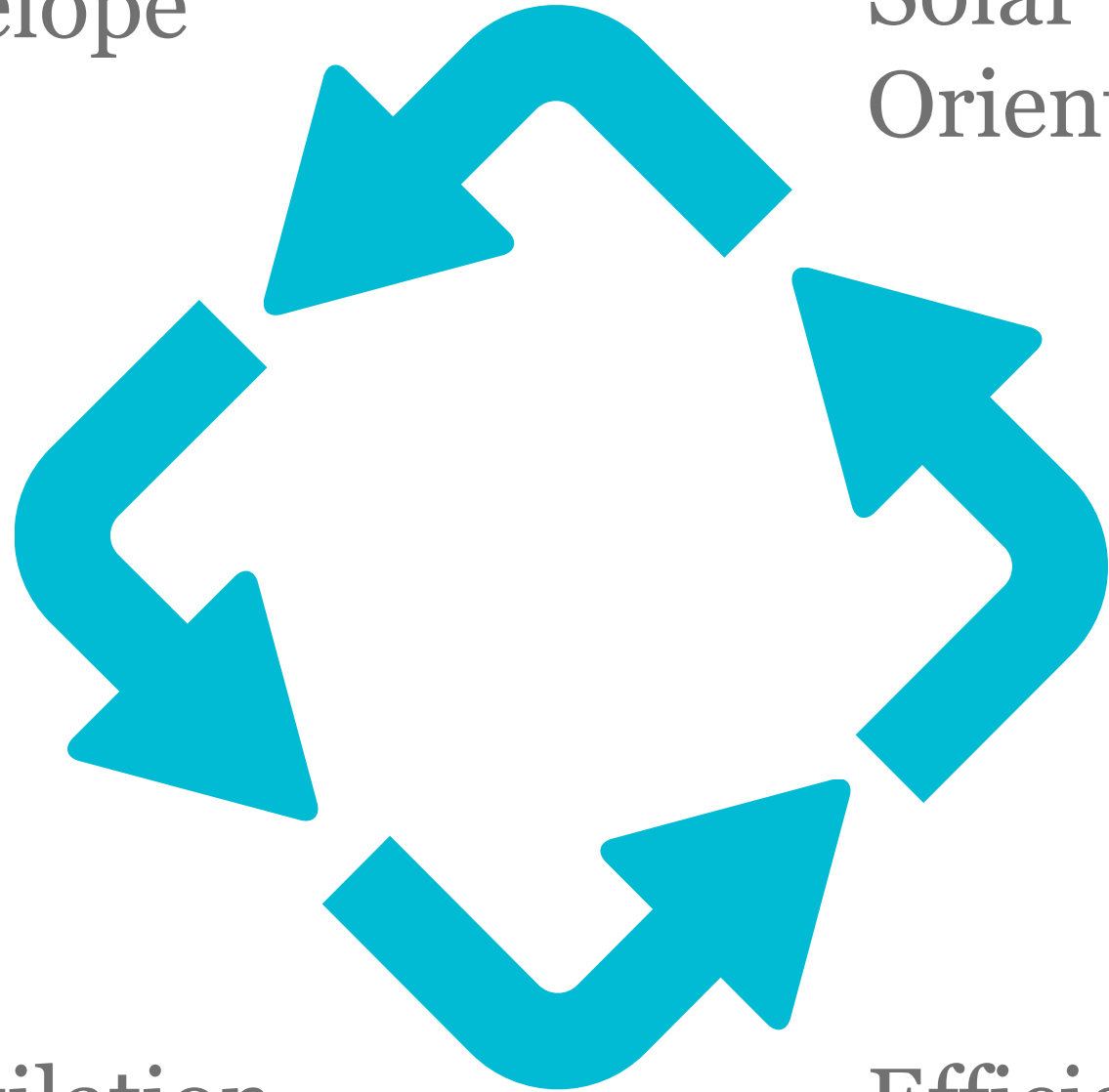


Passive
Building Is
Not An A La
Carte
Menu...

It's A System

Envelope

Solar
Orientation

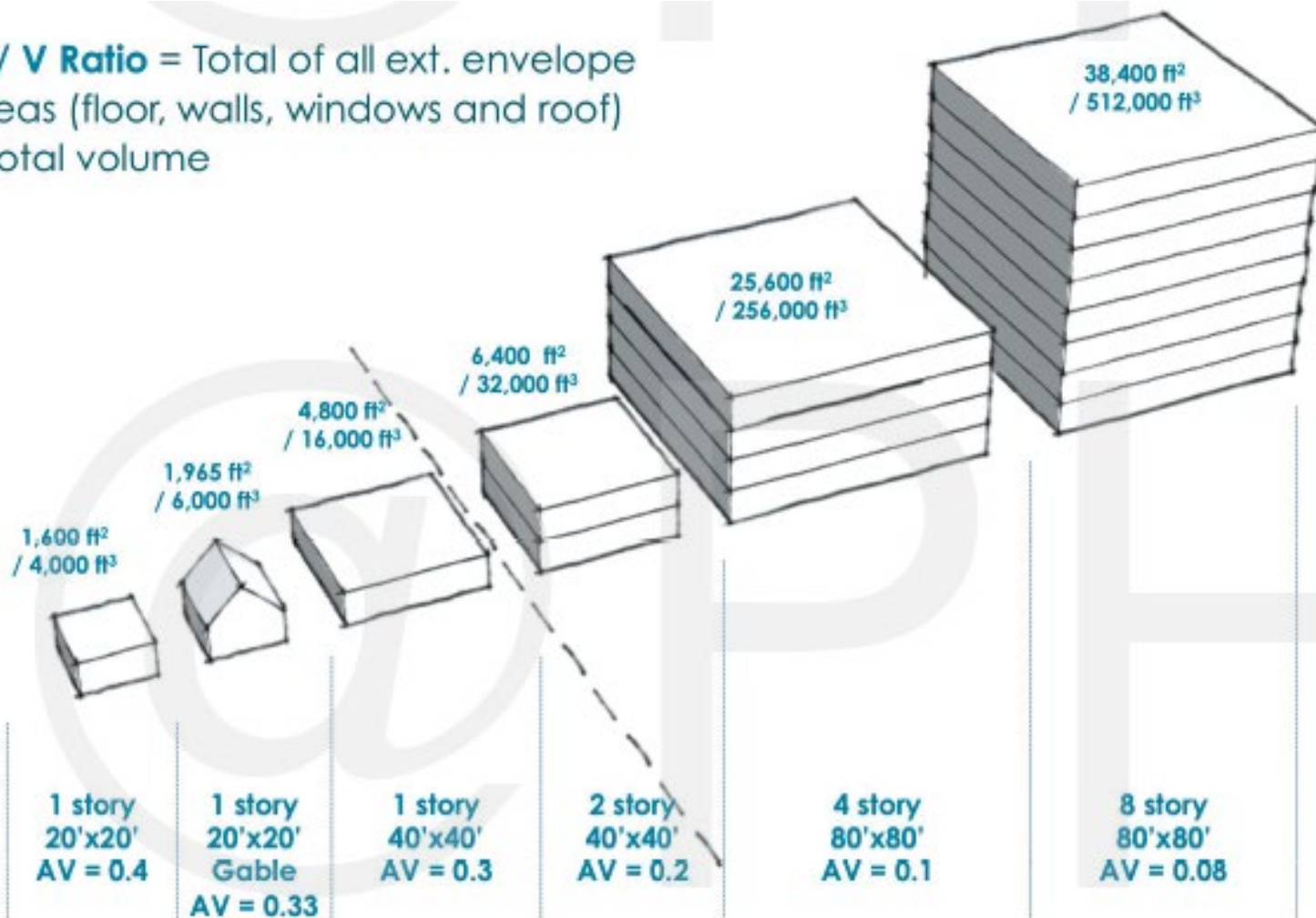


Ventilation

Efficiency

SURFACE AREA TO VOLUME (A/V) RATIO

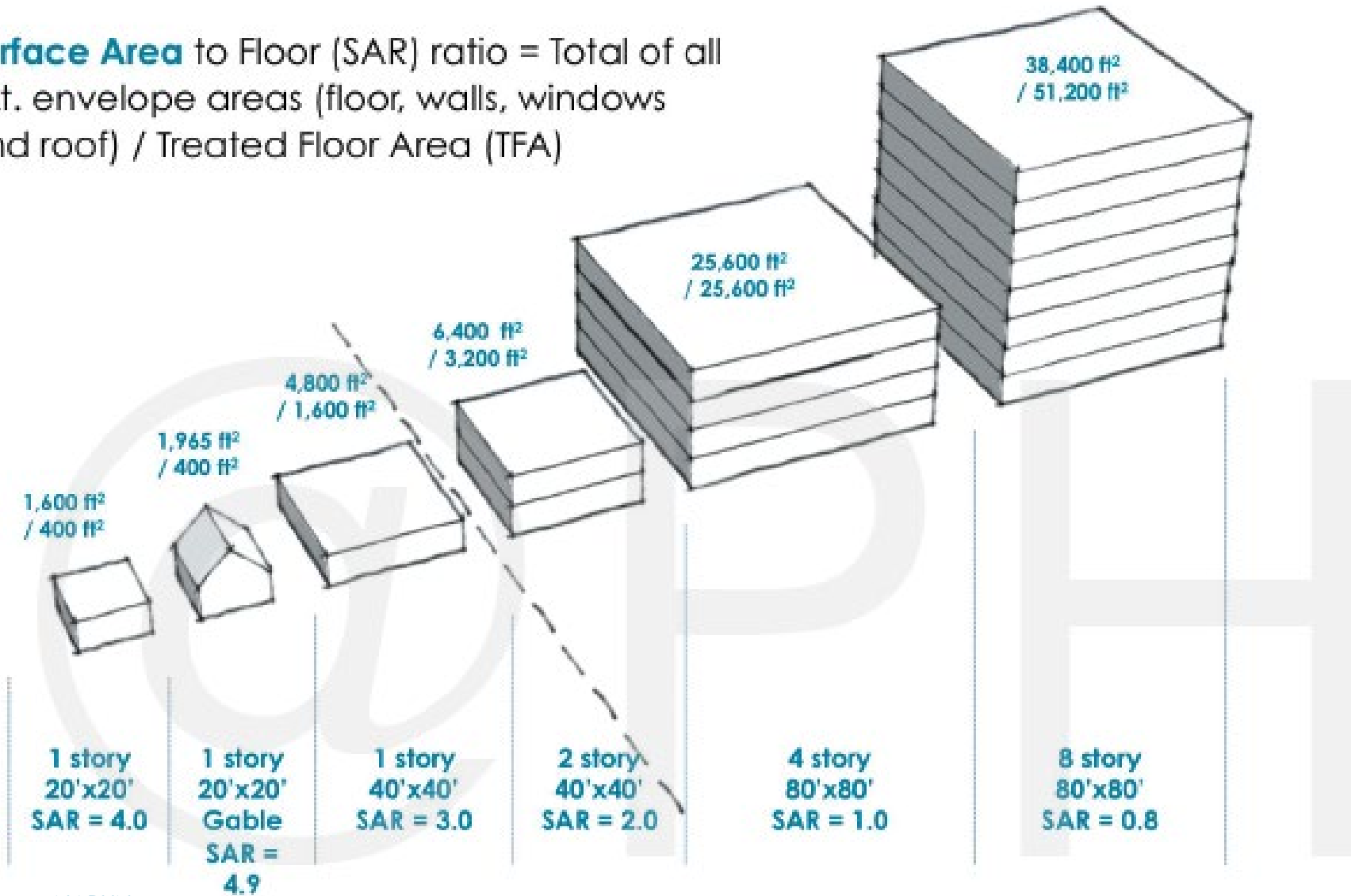
A / V Ratio = Total of all ext. envelope areas (floor, walls, windows and roof) / total volume



Source: NAPHN

SURFACE AREA TO FLOOR RATIO

Surface Area to Floor (SAR) ratio = Total of all ext. envelope areas (floor, walls, windows and roof) / Treated Floor Area (TFA)

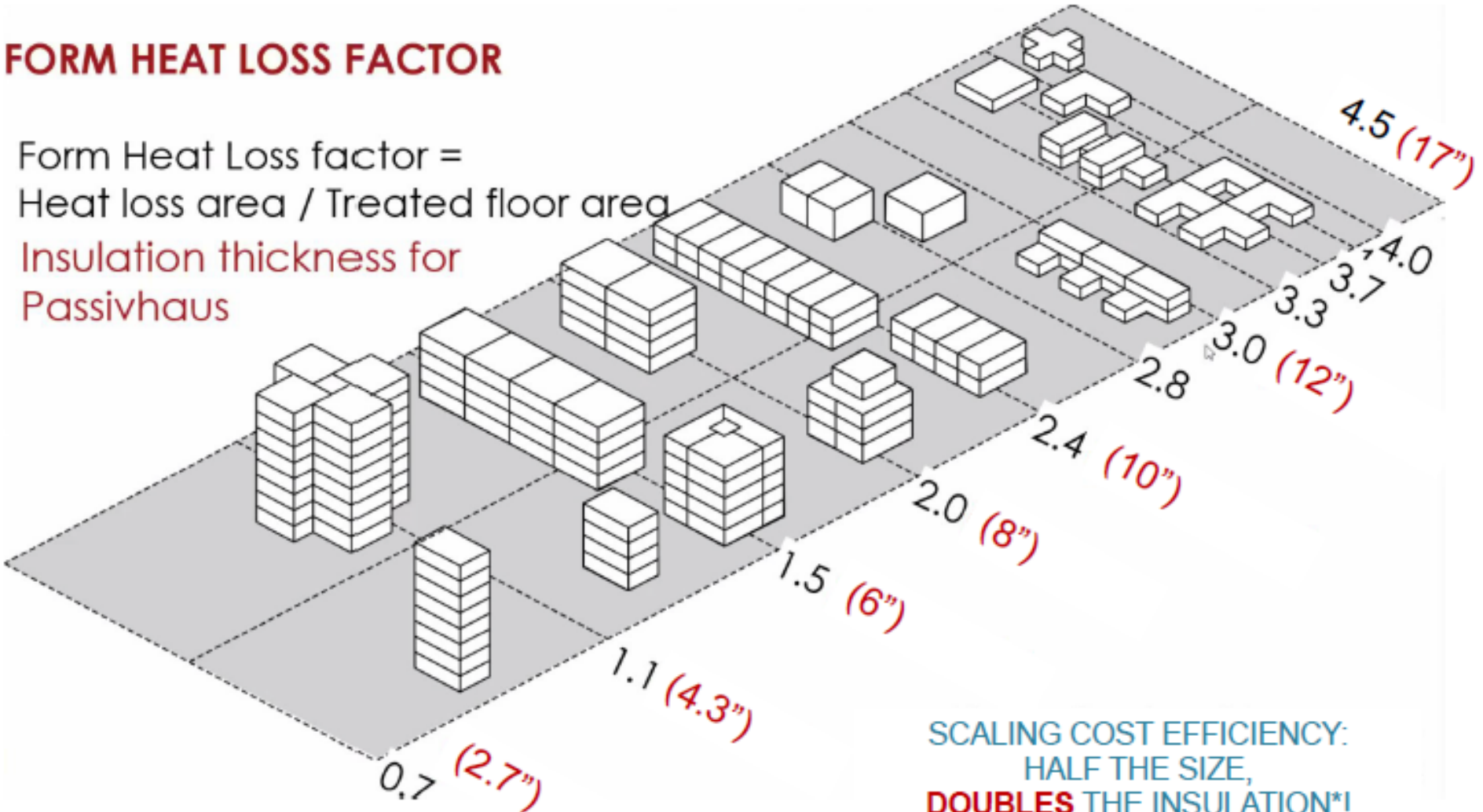


Source: NAPHN

SUPPORTING COST-EFFECTIVENESS

FORM HEAT LOSS FACTOR

Form Heat Loss factor =
Heat loss area / Treated floor area
Insulation thickness for
Passivhaus



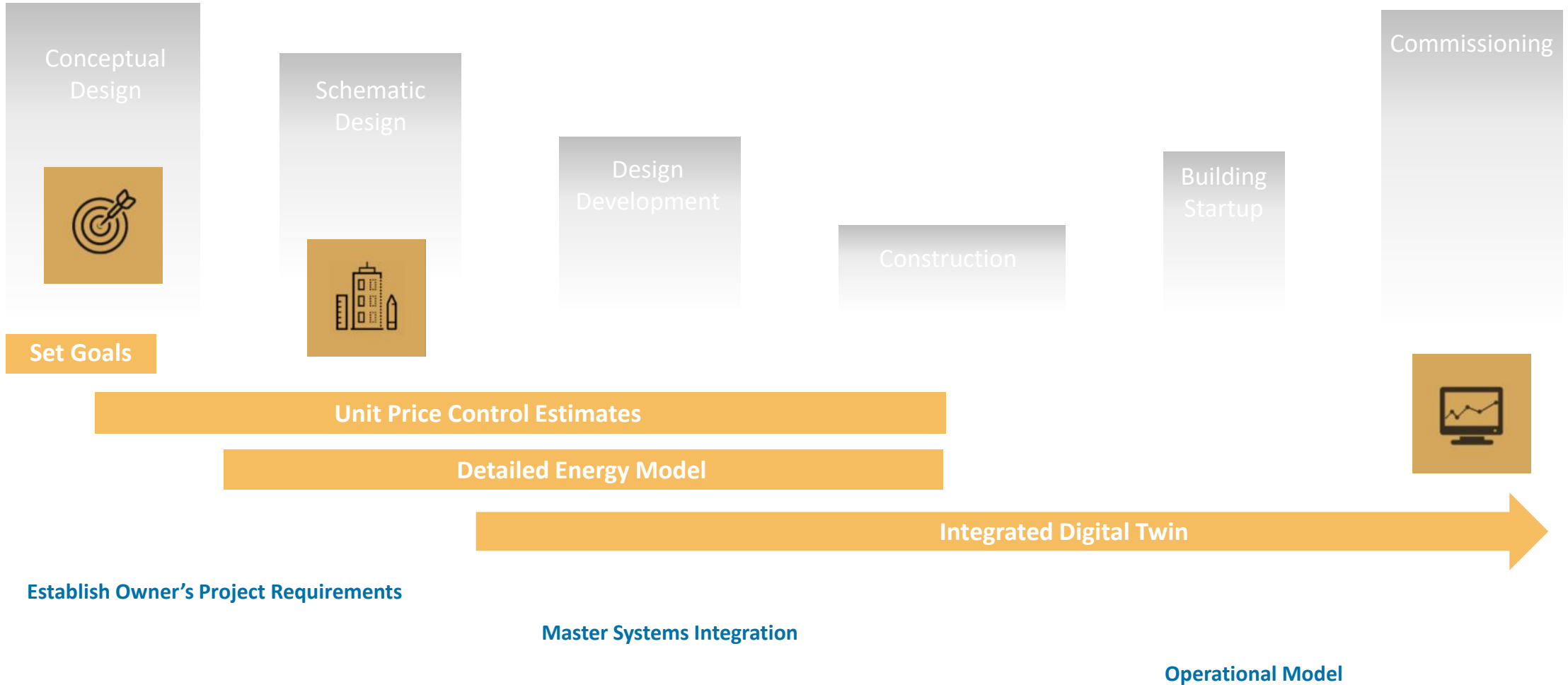
SCALING COST EFFICIENCY:
HALF THE SIZE,
DOUBLES THE INSULATION*!

(*Thickness based on Tahoe Climate)

Source: NAPHN

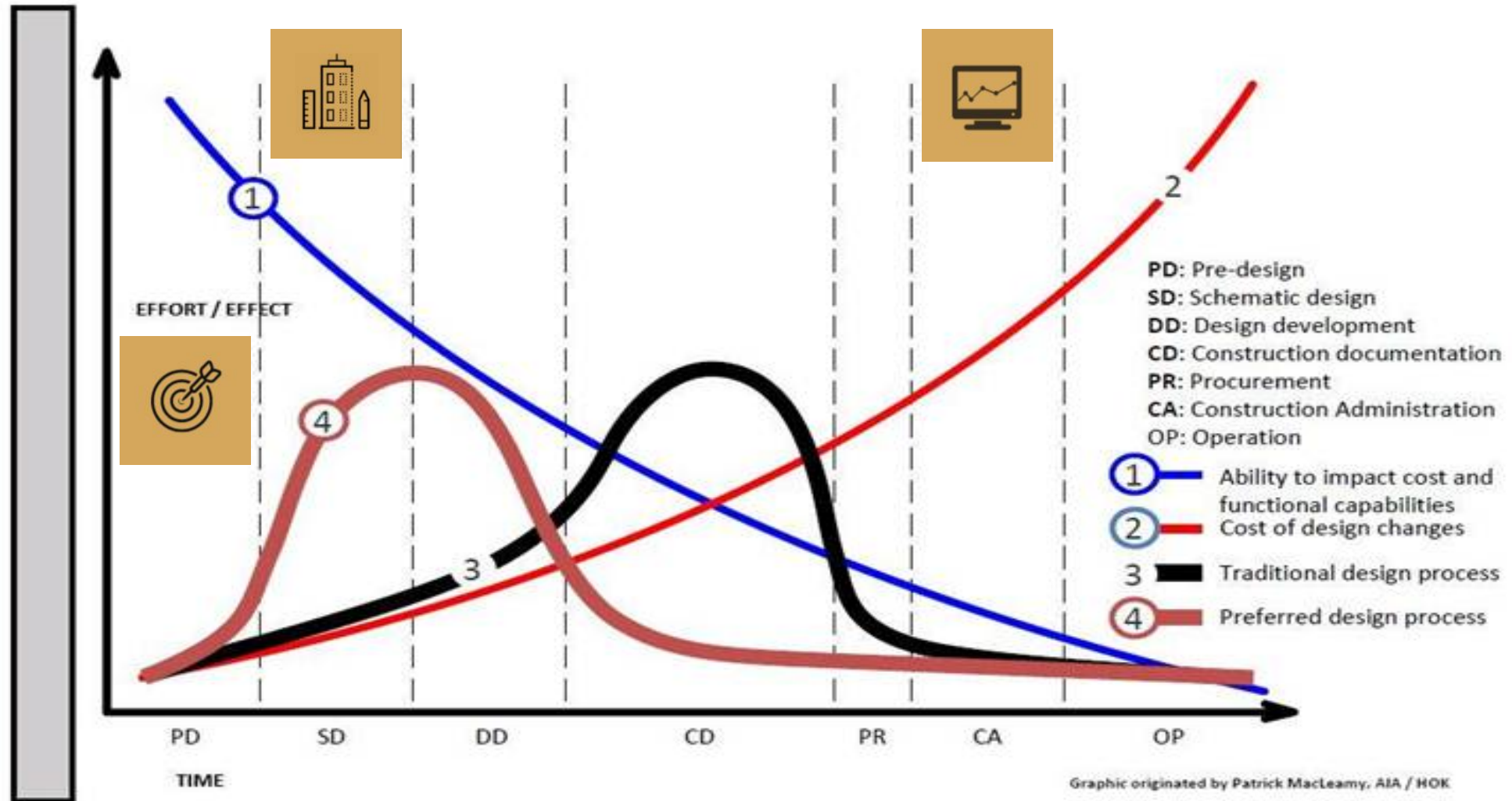
RESILIENCE

Strategies during project delivery



RESILIENCE

Strategies to reach goals



QAQC



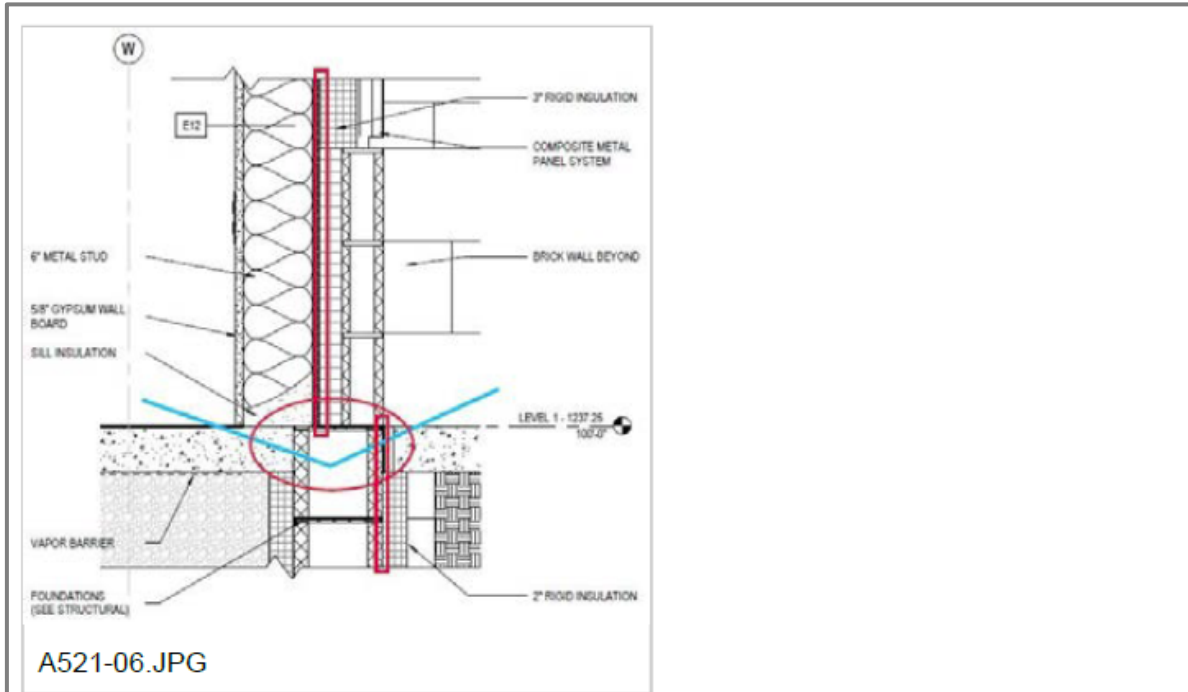
High Performance Buildings require early planning and field coordination

Contractor Sourcing: delineation of work, material sourcing, field-testing.

QAQC: Integration into project schedule, early planning, tradesperson orientation, proper sequence.

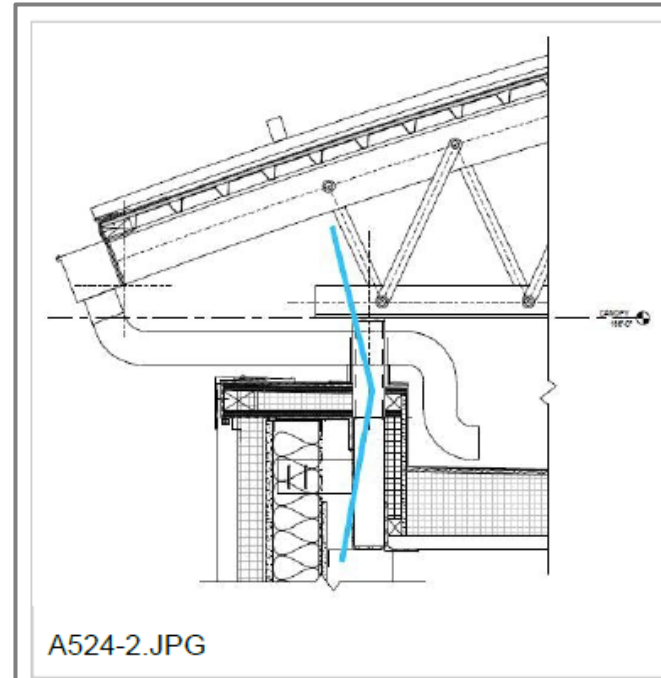


ENVELOPE DETAIL EXAMPLES



DR-2-10 OPEN HIGH

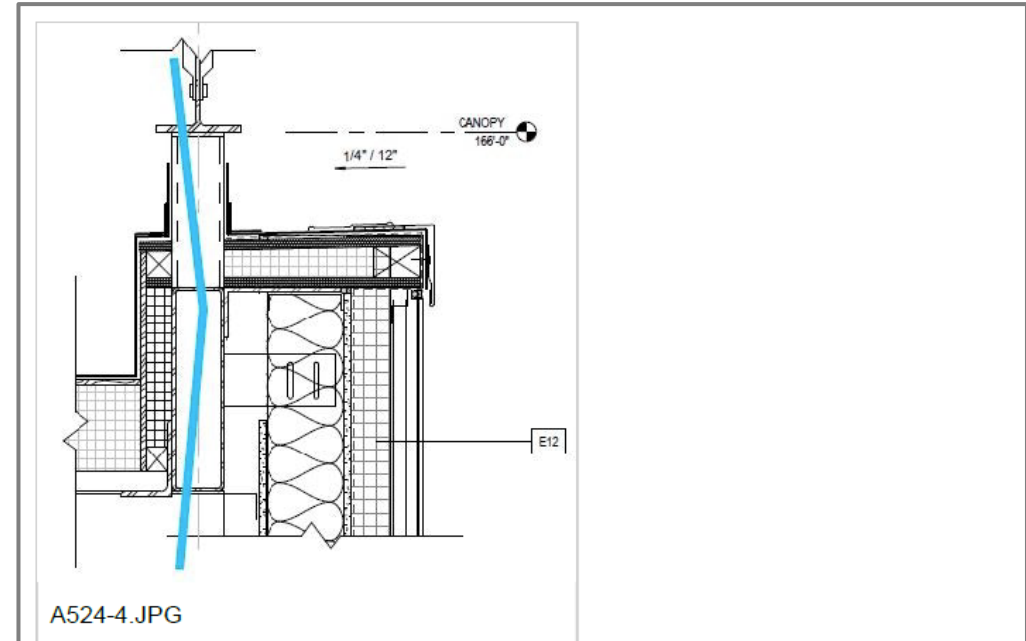
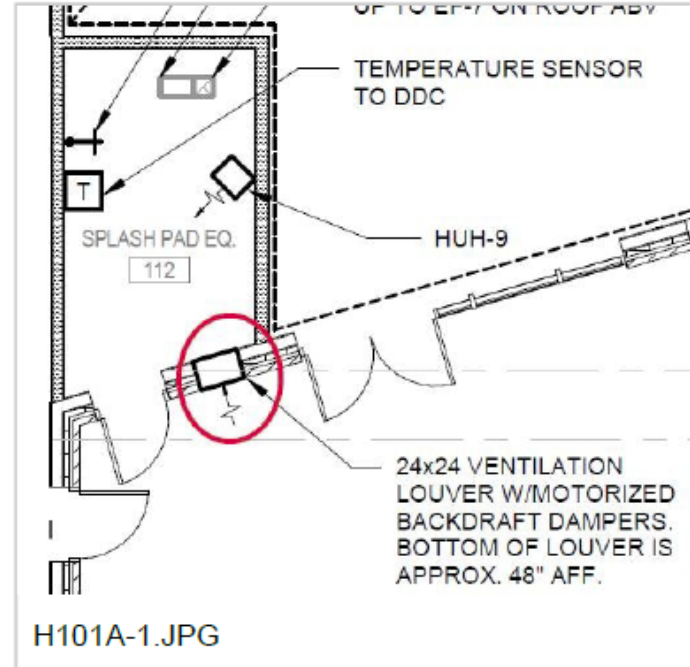
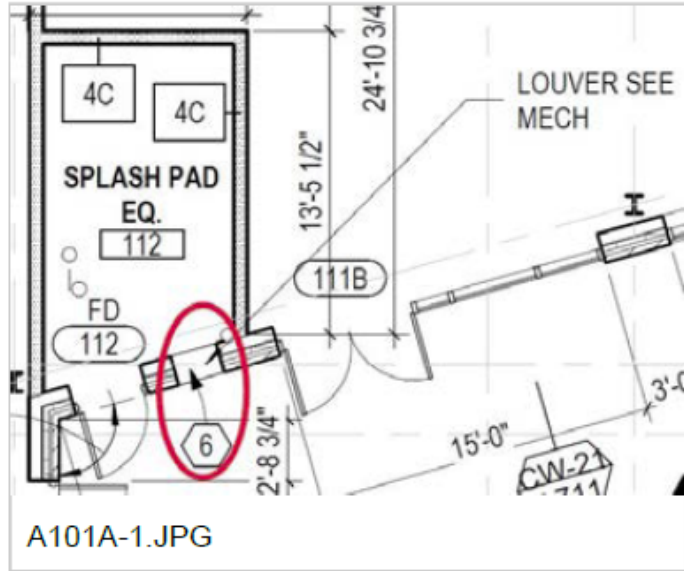
Continuity of air barrier at parapet is not clear, similar to the description in DR-2-8. The flashing at the curtain wall head is not labeled. The air barrier at the curtain wall head is not detailed properly. There is also a break in the insulation layer at the curtain wall head. These problems could lead to air leakage, water leakage, and excessive heat transfer at the parapet and the window head.



DR-1-9 OPEN HIGH

The steel post from the zipline tower canopy penetrates the parapet and connects to the steel structure inside the building, at Platform 006. This will allow excessive heat transfer through the building envelope, and could lead to condensation and moisture damage to building materials.

ENVELOPE DETAIL EXAMPLES



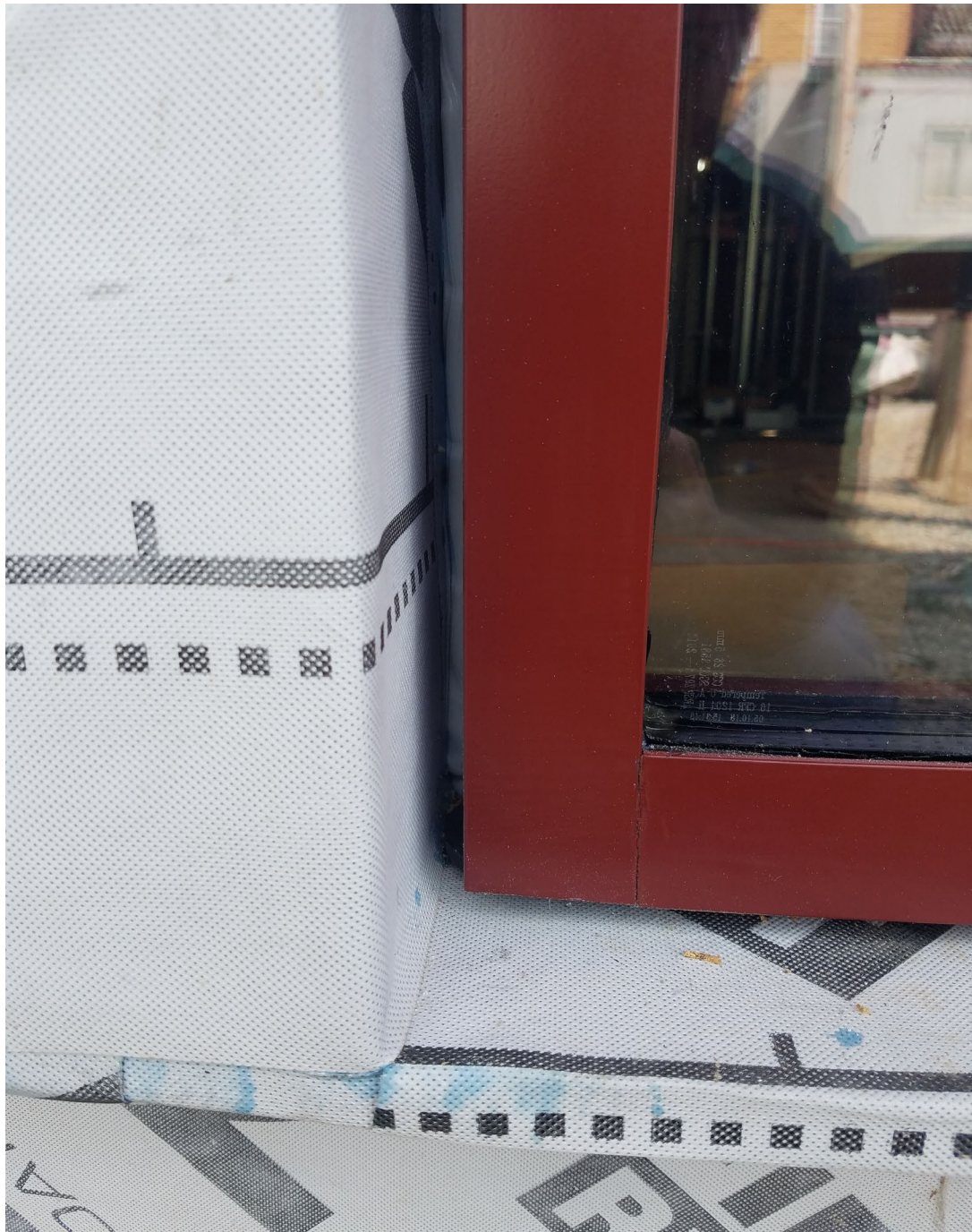
DR-2-29 OPEN HIGH

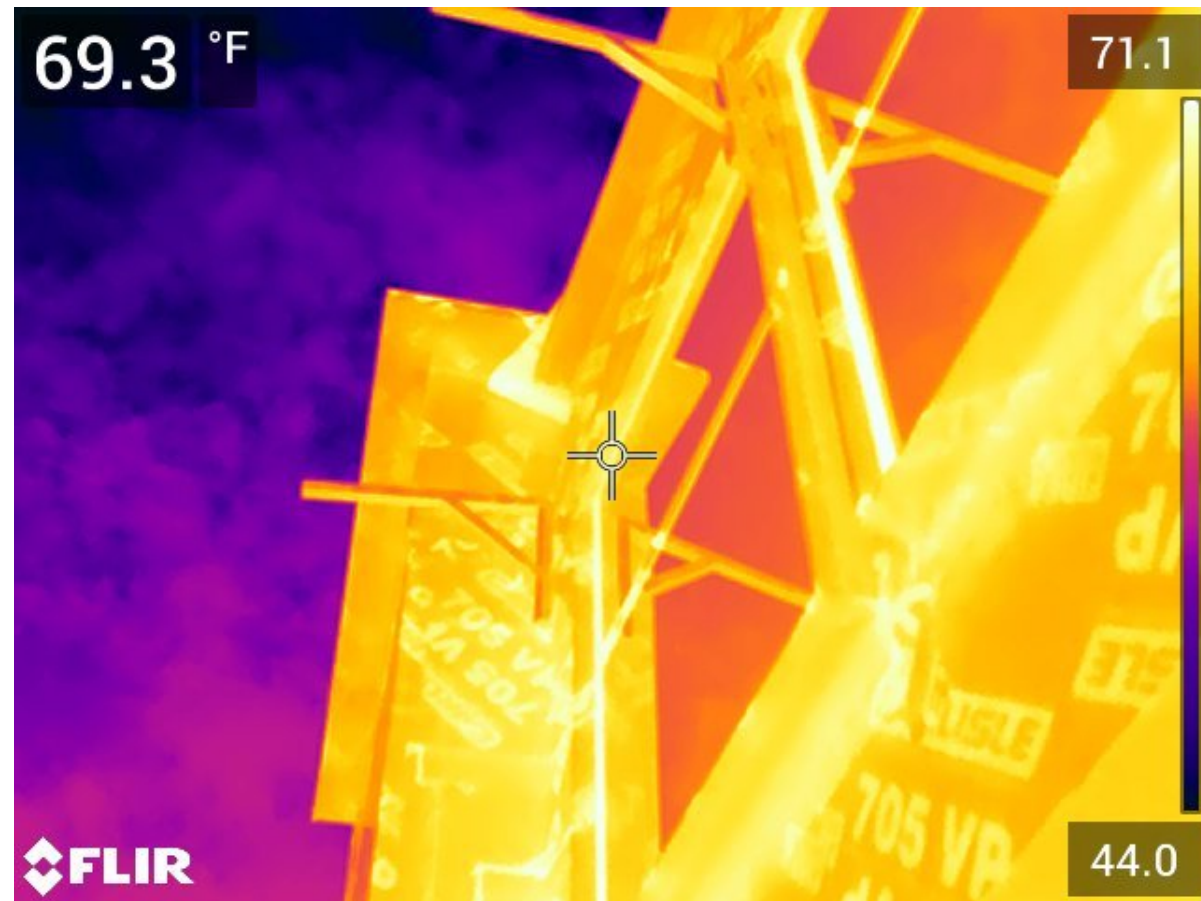
The flashing at the curtain wall head is not labeled. The air barrier at the curtain wall head is not detailed properly. There is also a break in the insulation layer at the curtain wall head. These problems could lead to air leakage, water leakage, and excessive heat transfer at the parapet and the window head.

DR-1-10 OPEN HIGH

The zipline platform railing steel support posts penetrate the roof membrane & insulation, and connect to the top flanges of the steel beams below the platform. This will allow excessive heat transfer and could lead to condensation and moisture damage to building materials.

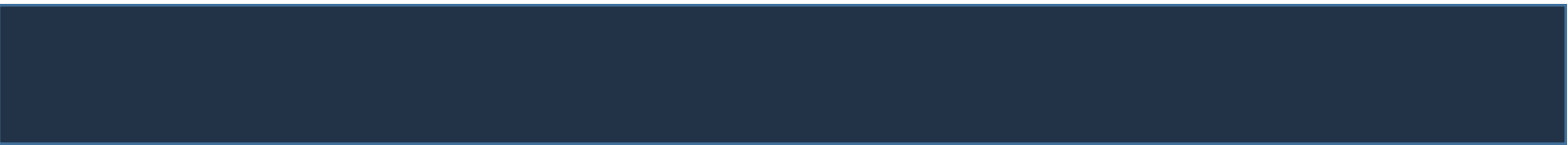






Fish Mouth & Dog's Ears

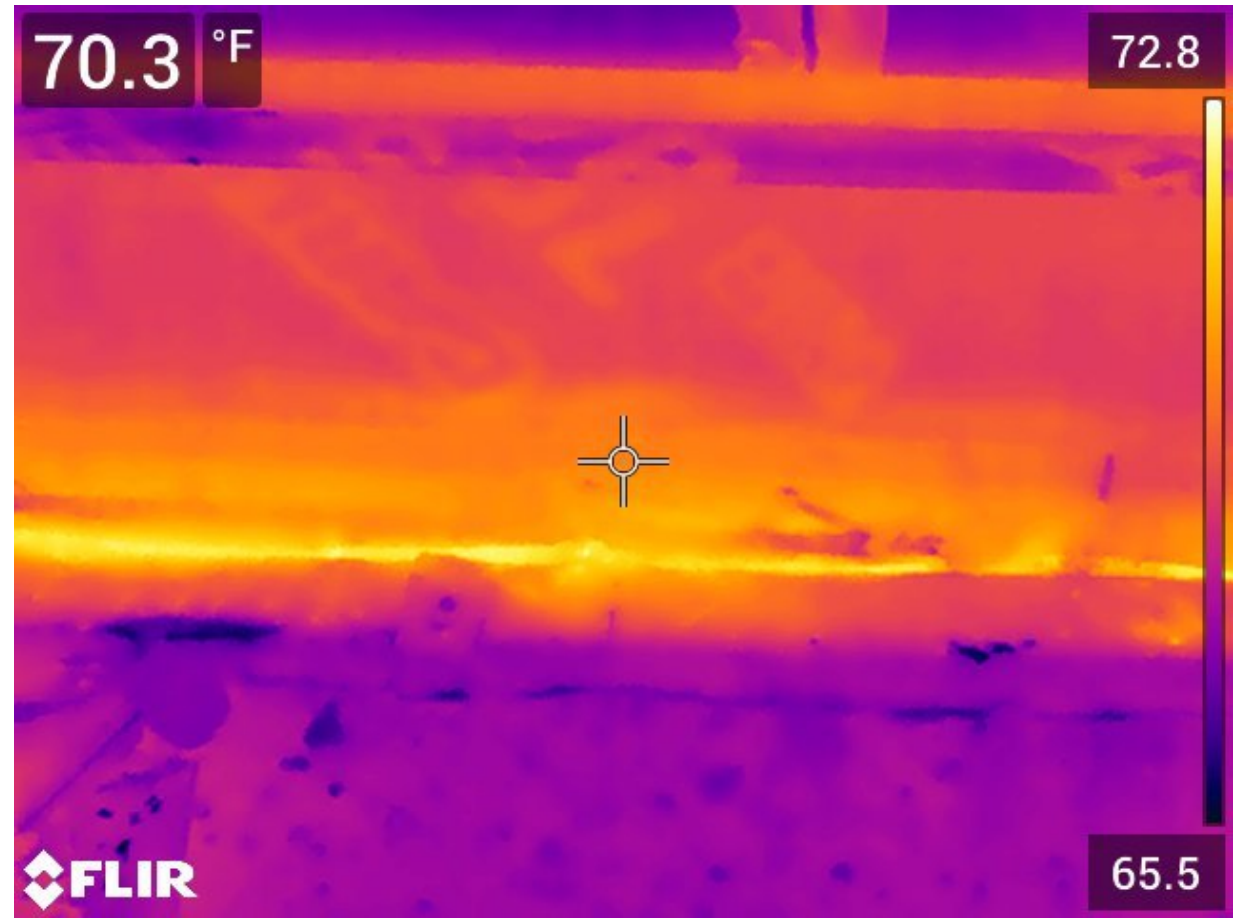


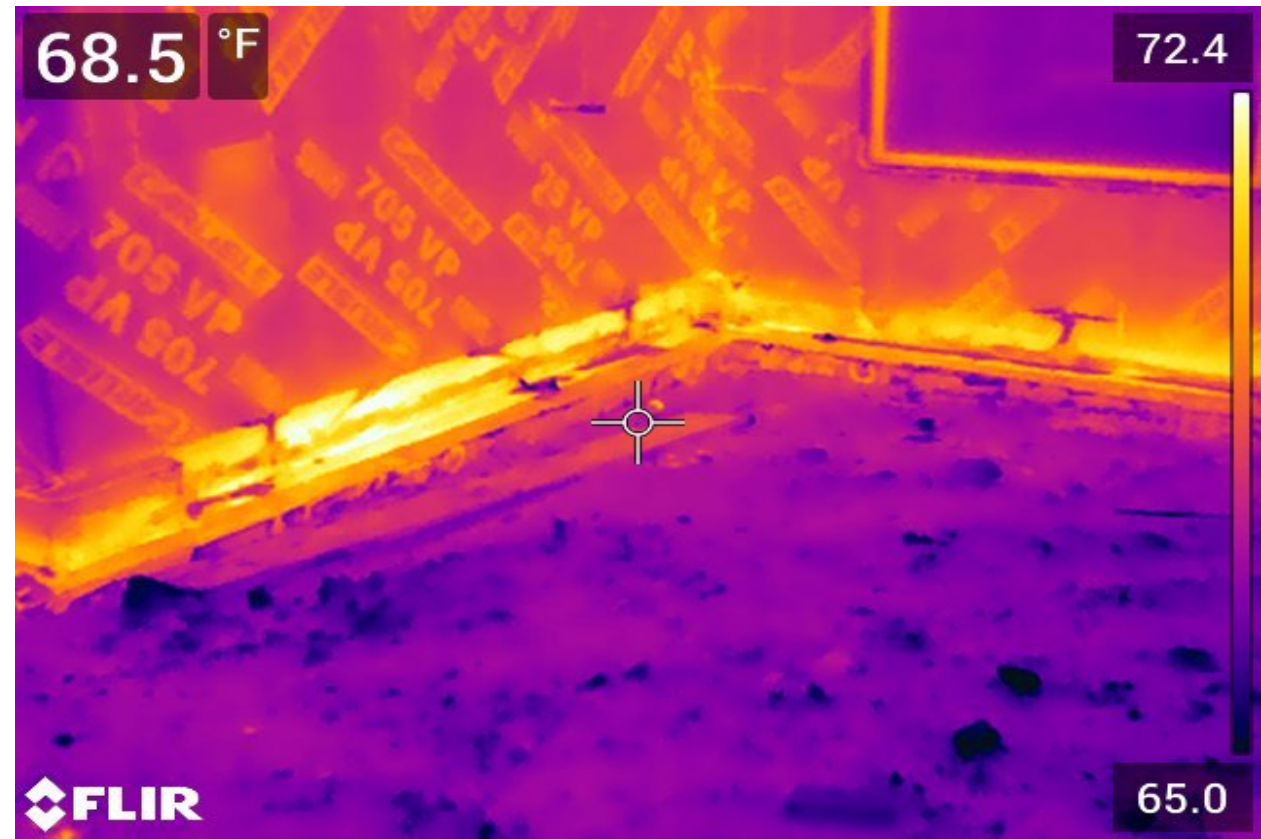


Air Barrier Transitions





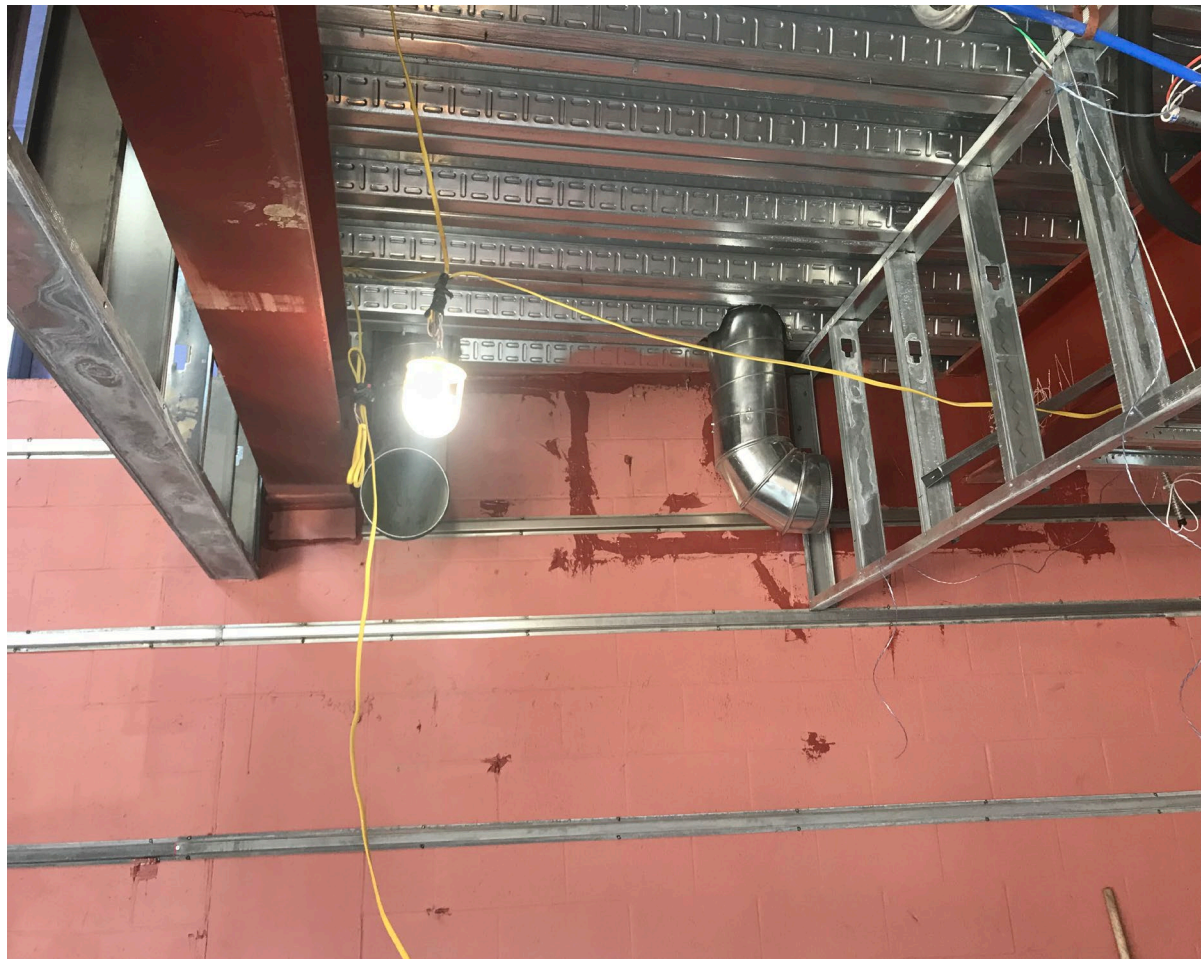












Spray It!
Don't Tape It!

Roofing

Not mechanically fastened
but adhered

COMMERICAL PH BUILDING EXAMPLES



Emerald Hills Affordable Multi-Family



North Negley Avenue Affordable Multi-Family



Carnegie Library Carrick Branch



Environmental Charter School A path to Passive House



ECS renovated an abandoned middle school using Passive House principles to reduce energy consumption. The building is using roughly 25% less energy than code-based construction. The middle school opened for the 2019 school year.

“We are taking the Passive House plunge because it is the most holistic, systems-based approach to tackling the renovation of old buildings to make them perform like new. Our planet, our students and our staff demand that we prioritize low energy, low carbon and healthy & equitable indoor air quality.”

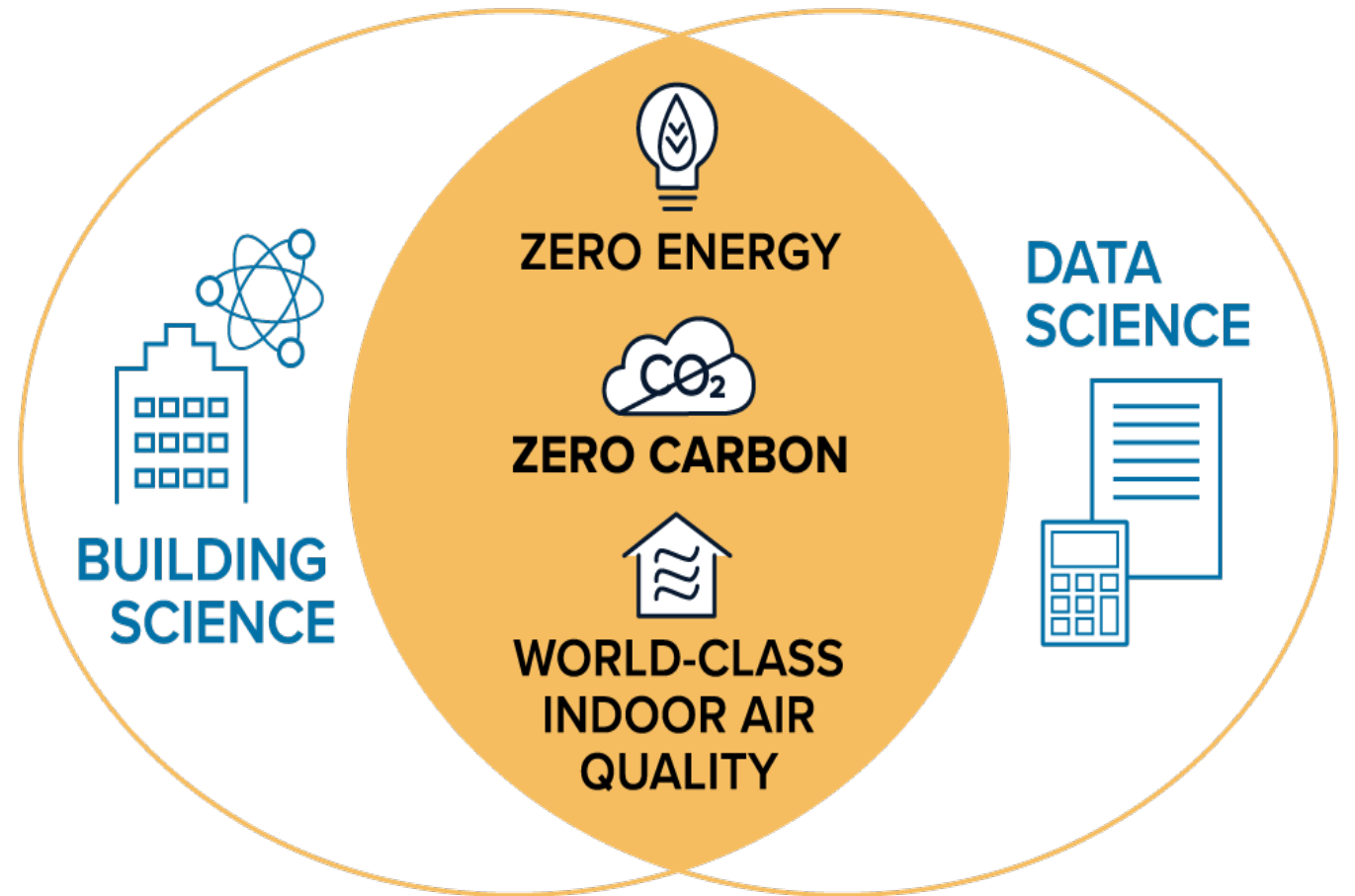
Nikole Sheaffer, Chief Innovation Officer, ECS

ECS will now build a new high school and is pursuing full Passive House certification, implying that the school will use roughly 75% less energy than traditional construction. Passive House enables ultra-low energy use and world-class indoor air quality, both of which are essential to the ECS mission of protecting the planet and impacting social equity in their unique learning environment.



Resilience

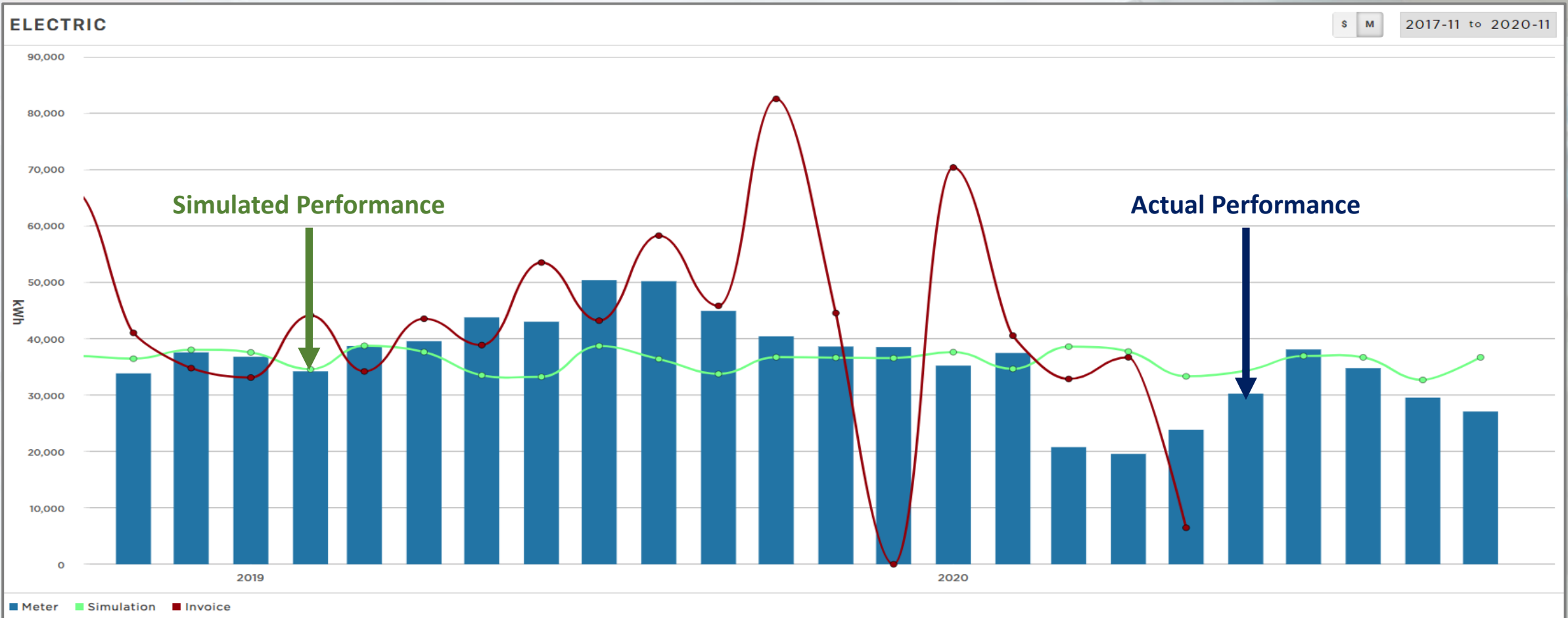
BUILDING SCIENCE
MEETS
DATA SCIENCE





MEASURING PERFORMANCE

Putting theory into practice provides proof





WE CANNOT GET OUT OF THE ENERGY CRISIS BY **BUILDING NEW**



THANK YOU

Q & A

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