



We will be starting soon!



Thanks for joining us



1

High Performance as the Baseline

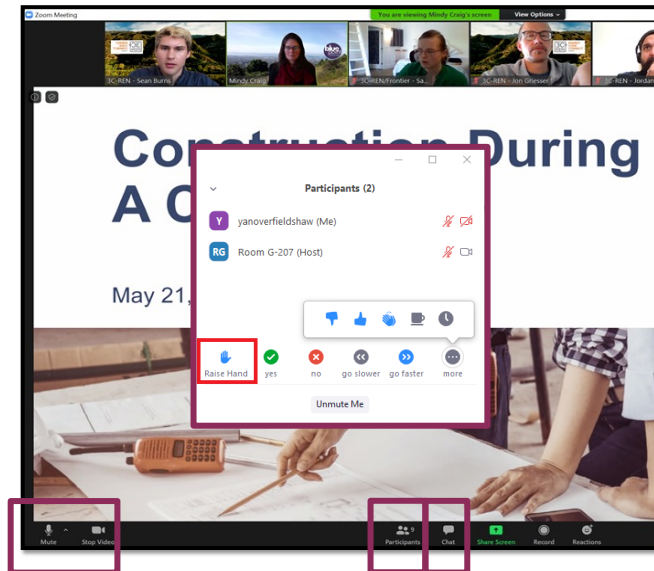
Jay Gentry, Passive House California
November 8, 2022



2

Zoom Orientation

- Please be sure your full name is displayed
- Please **mute** upon joining
- Use "**Chat**" box to share questions or comments
- Under "**Participant**" select "**Raise Hand**" to share a question or comment verbally
- The session may be **recorded** and posted to 3C-REN's on-demand page. Feel free to ask questions via the chat and keep video off if you want to remain anonymous in the recording.



3




3C-REN
Staff Online



4

3C-REN: Tri-County Regional Energy Network

- Three counties working together to improve energy efficiency in the region
- Services for –
 - **Building Professionals:** industry events, training, and energy code compliance support
 - **Households:** free and discounted home upgrades
- Funded by ratepayer dollars that 3C-REN returns to the region




The map shows the three counties of the Tri-County Regional Energy Network: San Luis Obispo County (purple), Santa Barbara County (orange), and Ventura County (yellow). The map is set against a light blue background representing the ocean and a grey background representing the rest of the region.

5

3C-REN Programs


- **Energy Code Connect (ECC)**
 - Industry Trainings and Regional Forums
 - [Energy Code Coach](#): Title 24 Compliance Support Hotline (805) 220-9991
- **Building Performance Training (BPT)**
 - Industry Trainings & Certification for current and perspective building professionals
 - Helps workers thrive in an evolving industry
- **Home Energy Savings (HES)**
 - Flexible Home Energy Upgrades
 - Multifamily (5+ units) & Single Family (up to 4 units)




The logo for 3C-REN is located in the bottom right corner of the slide. It consists of the letters '3C' stacked above 'REN' inside a square border.

6

High Performance as the Baseline



Jay Gentry, Passive House California
November 8, 2022



Passive House + Low Embodied Carbon + Electrify Everything + Clean Energy = **Climate Action**

7

Thank you for the Opportunity



Jay Gentry

- Graduate of UCLA Business School
- USAF Instructor Pilot
- Marketing and Sales Consultant
- Narrowed Focus to Emerging Building Performance Industry (2008)
- Passive House California Board of Directors
- Advocate for High-Performance Design, Building & Retrofitting



8

Passive House California



Our mission is to promote awareness, understanding, and application of the Passive House standard through education, events, and advocacy - focused on professionals, policy makers, and the general public throughout California.



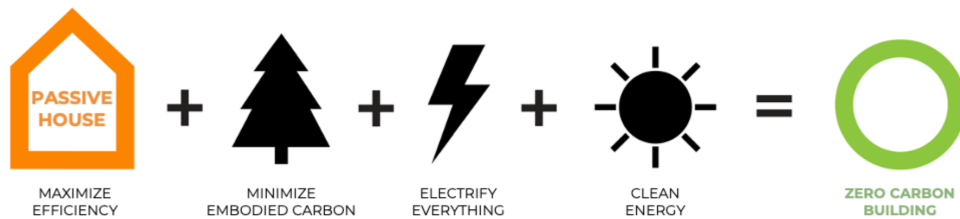
Monthly EpiPHany

The Natural Order of Decarbonization



First, we acknowledge the extremely important success of the Decarbonization Coalition (buildingdecarb.org) in their efforts to drive the electrification of the built environment. As a result of their work, over 50 California cities/counties have committed to phase out natural gas in new buildings. The Decarbonization Coalition's traction with municipalities and other entities is advancing the conversation to include all four of the imperative factors that will enable the decarbonization of the built environment — and the achievement of California's bold climate and efficiency goals.

The Natural Order of Decarbonization for new buildings is:

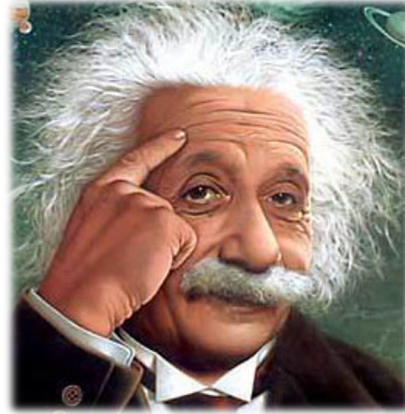


The above graphic implies a sequential process beginning with maximizing efficiency by employing Passive House protocols — and the actual construction is a relatively linear progression. However, because the factors work synergistically, it is critical that decisions regarding the integration of all four are made early in the design process. ([See The Logic of the MacLeamy Curve from a previous EpiPHany.](#))



High-Performance as the Baseline

- Baseline is
 - The minimum acceptable
 - The logical starting point
 - The standard
 - The guideline
 - The norm
 - The best practice



11

If Safety Features Optional...



Baseline Model

What if it did not include any of the Safety Features



+ Passive Safety Upgrades

Safety Belts, Airbags, Anti-lock Brakes, Energy Absorbing Frame, Air Sealing

...would you invest 5% more to get them?



12

The Baseline includes Safety Features

Preference upgrades are still available



Baseline Model

Safety Belts, Airbags, Energy Absorbing Frame, Air Sealing, and many more



+ Preference Upgrades

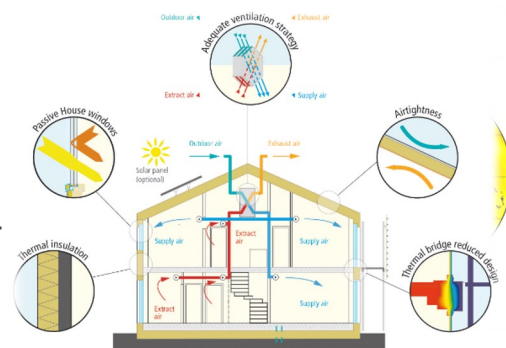
Sound system, XM radio, GPS, leather upholstery, tinted glass, video cameras, etc.



High-Performance as the Baseline



- **Contextual Elements**
- Evolution of High-Performance in Buildings
- Single-family and other small buildings
- Multifamily and other large buildings
- Call to Action



High-Performance Buildings



Evidence Based Climate Realities



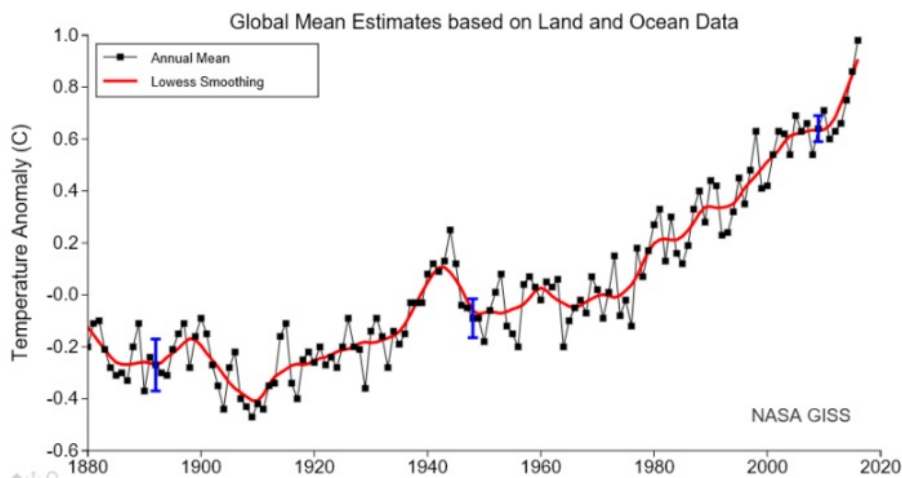
- The Climate Crisis is real
- Driven by GHGs from human activities
- Embodied and operational carbon from the built environment are major contributors
- We must maximize energy efficiency, minimize embodied carbon and shift to renewable energy
- Unprecedented action is required... now, and into the future
- YOU are part of that unprecedented action



15

15

10/25/21: UN warns world is on course for **Catastrophic Warming of 2.7°C**



16

The IPCC calls for “unprecedented action”

It is possible:
United States production of Military Aircraft

<3,000 in 1939

Mid 1944 — 3,000 Every 11 Days

17

High-Performance is Environmentally Responsible



Passive House

+



Low Embodied Carbon

+



Electrify Everything

+



Clean Energy

=



Climate Action

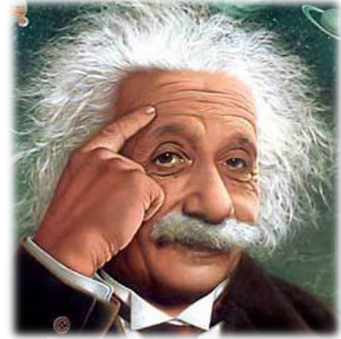


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Why “High-Performance Buildings”



- For Occupants
 - Energy bills minimized
 - Comfort – physical, emotional, and quiet
 - Health – fresh filtered air, minimal pollutants/allergens/toxins
 - Safety – resilient to heat/cold, fire, smoke, and power outages
- For Owners
 - Operational expenses minimized
 - Durability – structure, mechanical systems, moisture management
 - Maintenance expenses reduced
 - Increased fire resistance

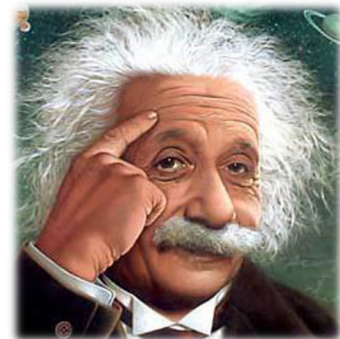


19

Why “High-Performance Buildings”



- For Communities
 - Resistance to wildfires and to the spread of fires and smoke
 - Increased opportunities for micro-grid and resilience to power outages
- To Fight Climate Change
 - Dramatically reduced green house gasses (GHGs)
 - Easier path to ZNE and ZNC for the built environment

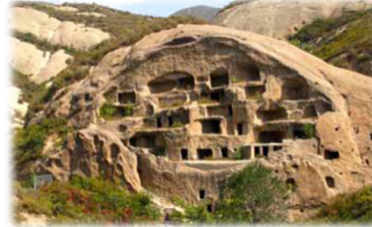


20

High-Performance as the Baseline

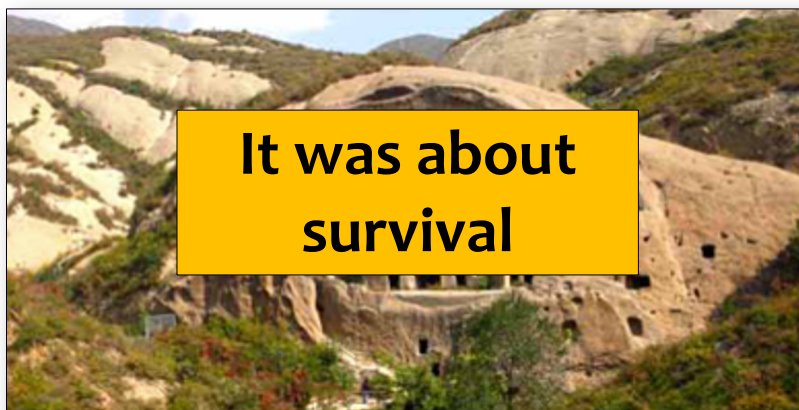


- Contextual Elements
- **Evolution of High-Performance in Buildings**
- Single-family and small buildings
- Multifamily and large buildings
- Call to Action



21

Intelligent and Purposeful Choices



Early humans learned to take advantage of what nature offers by choosing locations that provided access to water, comfort, safety, and light with minimal effort... conserving human energy



22

Intelligent and Purposeful Choices



Over time we shifted from human energy to fossil fuels and electricity (largely produced by burning fossil fuels)



23

Intelligent and Purposeful Choices



Passive House

+



Low Embodied Carbon

Survival is back on the table



Electrify Everything

=



Climate Action

Today's challenge — Decarbonize the built environment by: Maximizing Energy Efficiency, Minimizing Embodied Carbon, Electrifying Everything, and Shifting to Renewable Energy



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What a Difference 50 Years Makes



2009
Chevrolet
Malibu

1959
Chevrolet
Bel Air



25

What a Difference 50 Years Makes



If interested: YouTube – 1959 Bel Air versus 2009 Malibu Crash Test



26

What a Difference 50 Years Makes



Car Built to “Code” - 1959

1959 Buick has a long multiple wheelbase and a significant overhang



Car Built to “Code” - 2009

Safety Belts, Air bags, Anti-lock Brakes, Crayon Driving Frame



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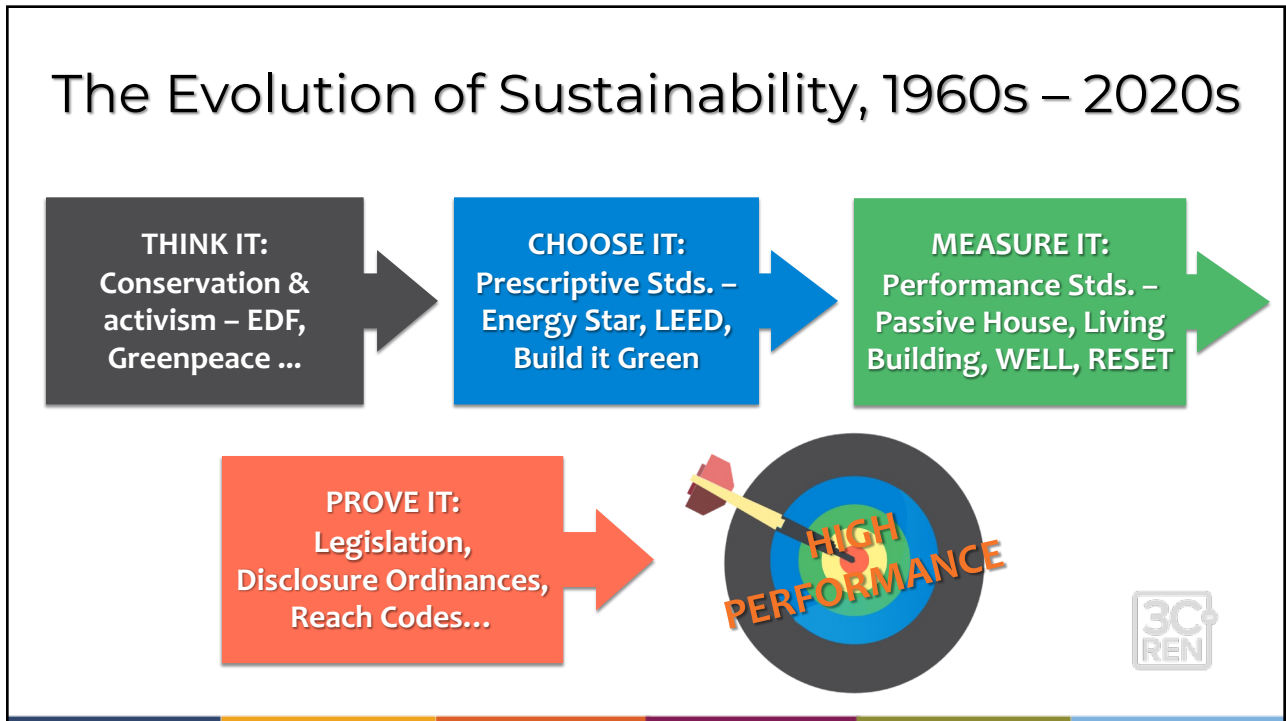
What a Difference 50 Years Makes



- The positive changes were enabled by:
 - Clarity on performance related goals and objectives
 - Application of analysis and science to achieve desired performance
 - Integration of innovative solutions
 - Commitment to deliver the expected results
 - Driven by regulation



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Passive House has Arrived

The world's most aggressive energy efficiency standard for buildings

PH CA

~200K SF >10M SF

2009 2018 2020

THE ORCHARDS

6520

3C-REN

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30

Passive House



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Passive House Office Building



32

Passive House Multifamily



33

Passive House City Block



34

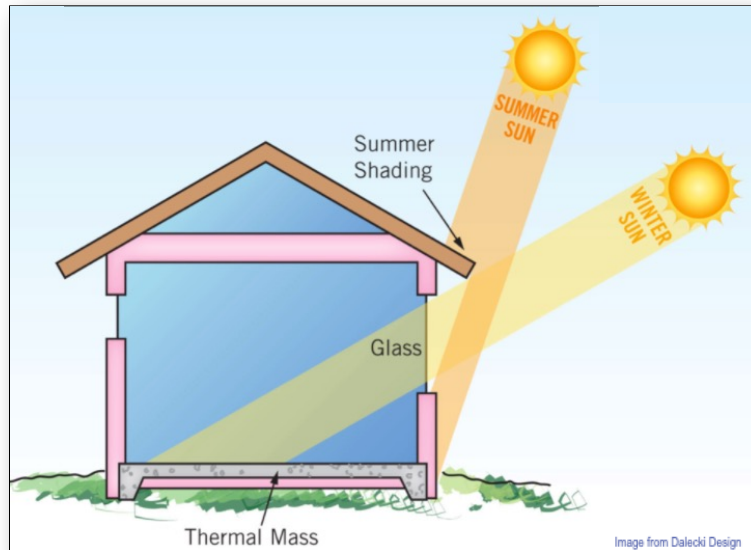


35



36

Passive solar: siting, orientation, shading



37

Passive - It's In the Name



- Solutions that deliver desired performance naturally, as a function of design
- And continue to deliver that performance over time with little or no intervention other than normal maintenance



38

Passive solutions deliver desired performance naturally, as a function of design...



Reverse diagonal parking



The wing on a race car

... and often, do not require any additional investment



39

Passive



Active



40

40



How Passive House Delivers Performance



Photo Credit: www.909BUILD.com



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- **An Airtight Shell or Envelope**
- **Sufficient Insulation**
(to avoid the intrusion of heat from the outside or the loss of heat from inside)
- **Continuous Fresh Air**



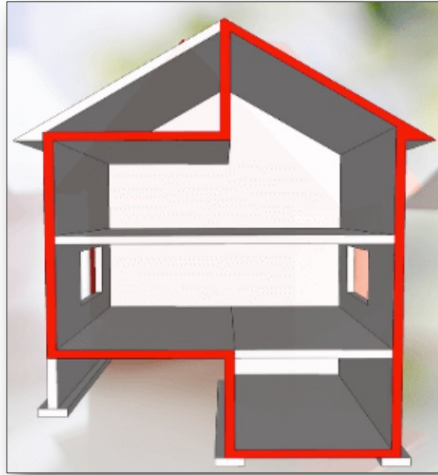
42

42

Passive House – The Basics



- Many elements but the big 3 are
 - **Airtight building shell**
 - Better insulation correctly applied
 - Mechanical ventilation with heat recovery



43

Passive House – The Basics



- Many elements but the big 3 are
 - Airtight building shell
 - **Better insulation correctly applied**
 - Mechanical ventilation with heat recovery



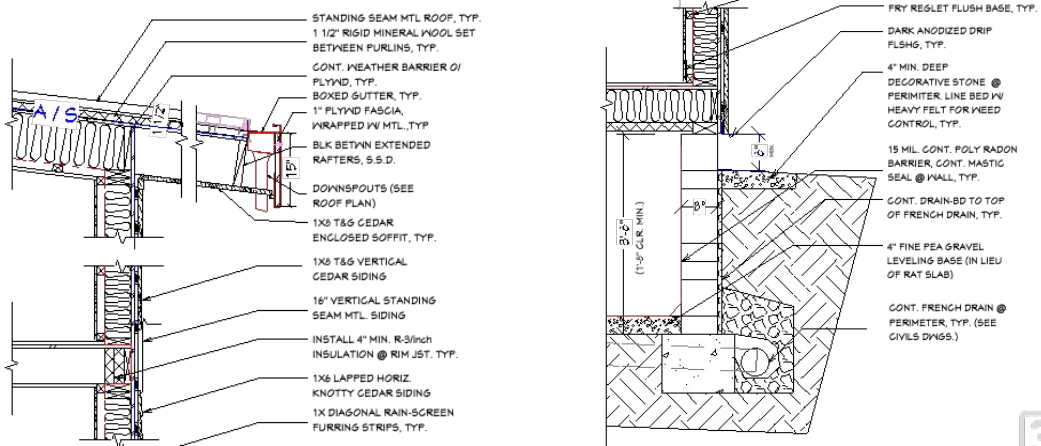
44

Insulated Thermos vs. Heated Pot



45

The same or similar materials and process... with different priorities and details



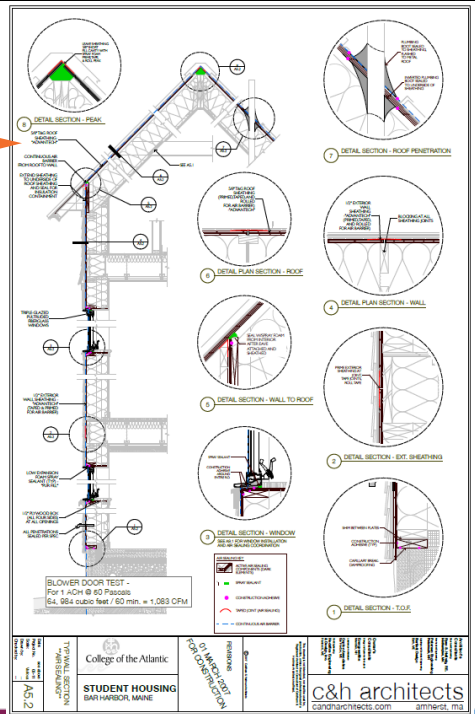
46

The envelope: air sealing

Air leakage control:

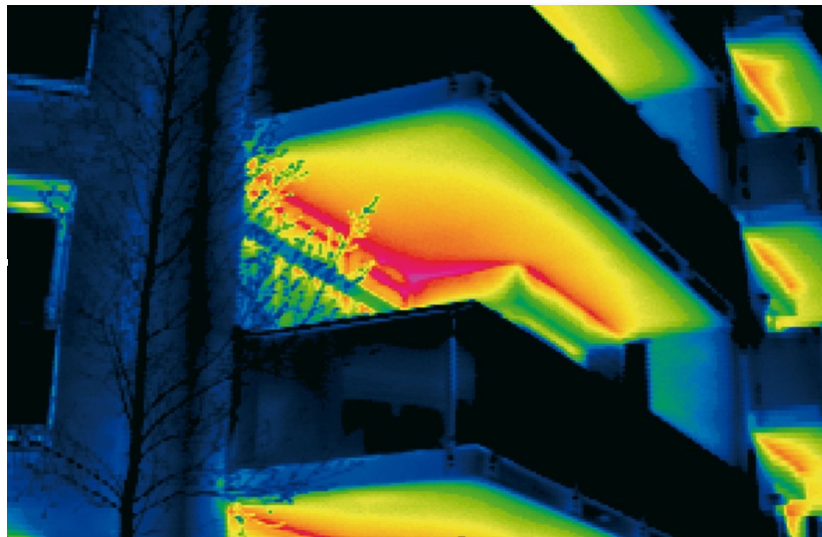
FREE DOWNLOAD: Air sealing drawing by Coldham & Hartman Architects →

- Details for air sealing & exterior insulation
- Air sealing cross section (keyed to details)
- Specifications for air sealing, insulation installation, other critical construction quality tasks
- Intent communicated to contractor & subs
- Quality managed during construction




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Eliminate Thermal Bridges

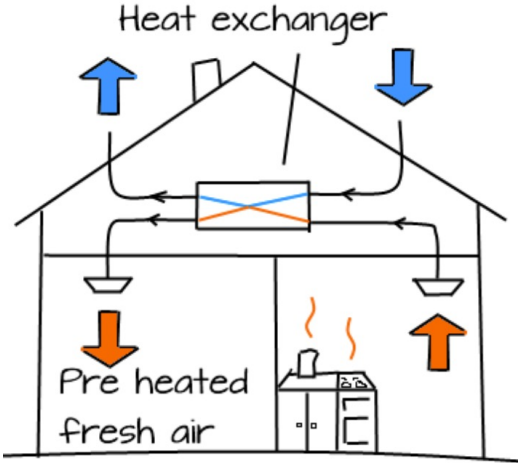



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Passive House – The Basics




- Many elements but the big 3 are
 - Airtight building shell
 - Better insulation correctly applied
 - **Mechanical ventilation with heat recovery**

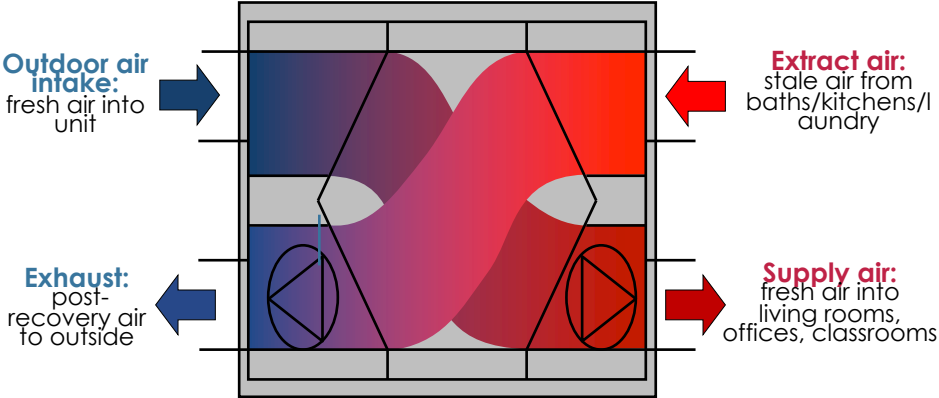





49

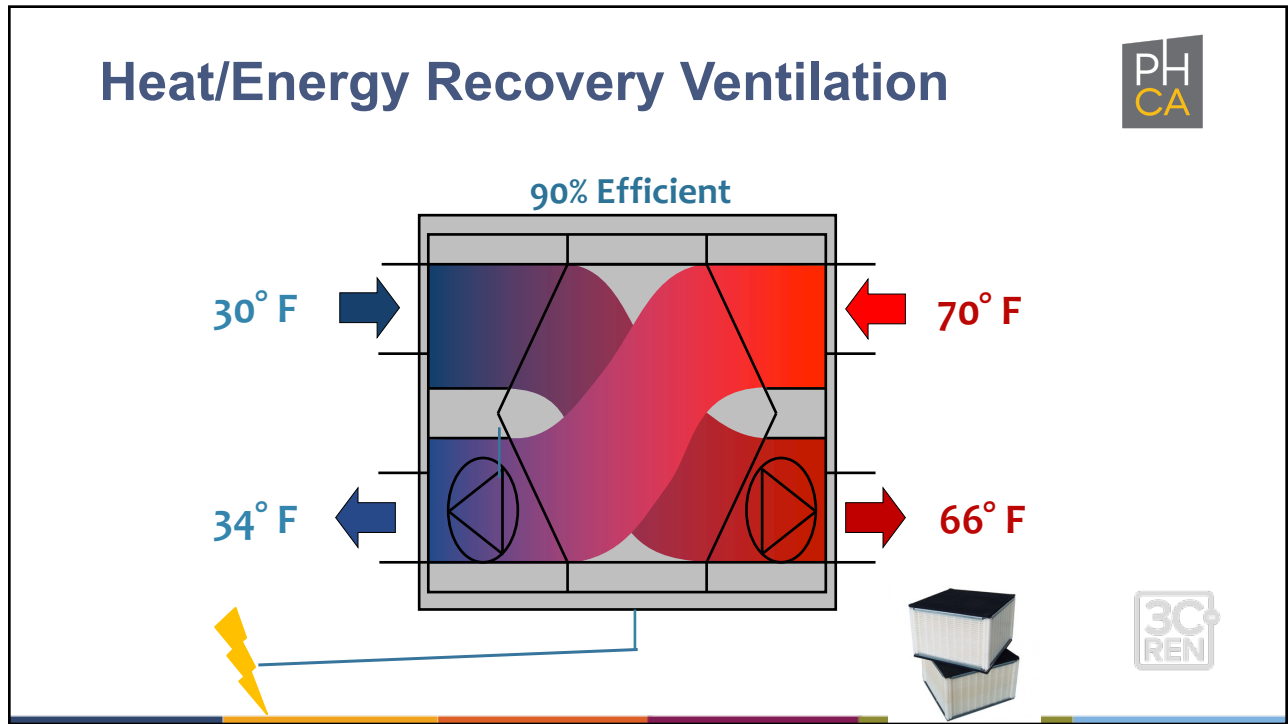
Heat/Energy Recovery Ventilation



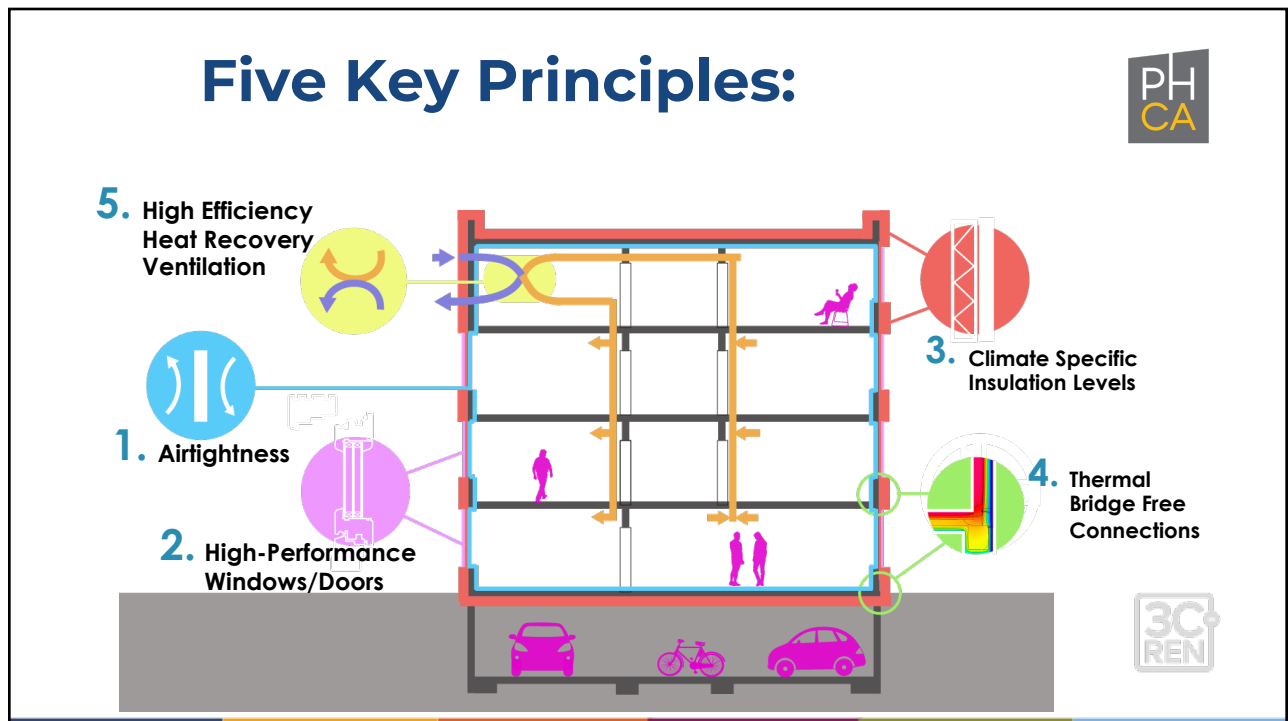




50



51



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Building Blocks to Achieve High Performance

Renewables
(To Net Zero or Beyond)

Balanced Ventilation with Heat Recovery
(Filtered as Appropriate)

Climate Specific Insulation
(No Thermal Bridges)


Airtight Building Envelope
(Including Windows and Doors)




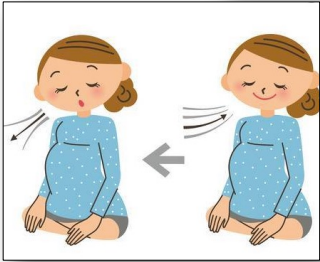
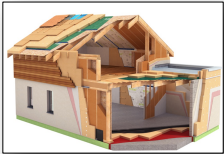

53

53

Initial Focus on Energy Efficiency



- All about the Envelope
 - Airtight, including windows and doors but moisture permeable
 - Insulation and No thermal bridges
- Gives you control of air quality
 - Balanced air exchange
 - Continuous fresh and filtered air
 - Very little exfiltration of conditioned air
 - Dramatically less unplanned infiltration of pollutants and allergens
- And resilience



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Passive House High-Performance



- 80% to 90% reduction in energy for heating/cooling
- Up to 70% reduction in energy for hot water
- Enhances, complements, and enables use of renewables
- Up to 95% reduction in energy for power
- Comfort, Health, and Resilience to extreme weather and power outages



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Climate Resilience



Vulnerabilities

- **Extreme heat or cold**
- **Wildfires**
- **Smoke/air pollutants**
- **Power outages**

High-Performance Solutions

- **Robust thermal enclosure**
- **Fire-hardened enclosure**
- **Airtight enclosure, fresh and filtered ventilation system**
- **Robust thermal enclosure, energy storage**

A HIGH-PERFORMANCE ENCLOSURE IS THE #1 PRIORITY FOR ACHIEVING RESILIENCE— and air sealing is the #1 priority for achieving a high-performance enclosure

Source: Ann Edminster

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High-Performance as the Baseline


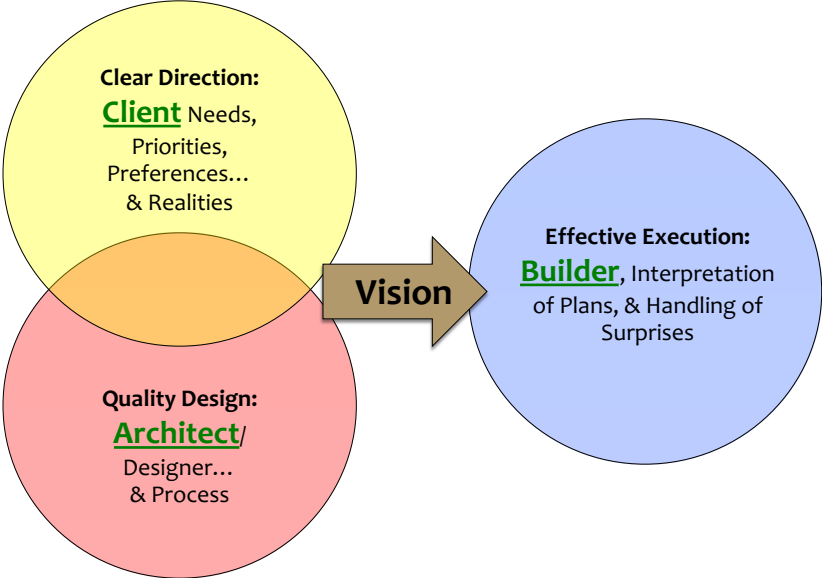



- Evolution of High-Performance in Buildings
- **Single-family and small buildings**
- Multifamily and large buildings
- Call to Action

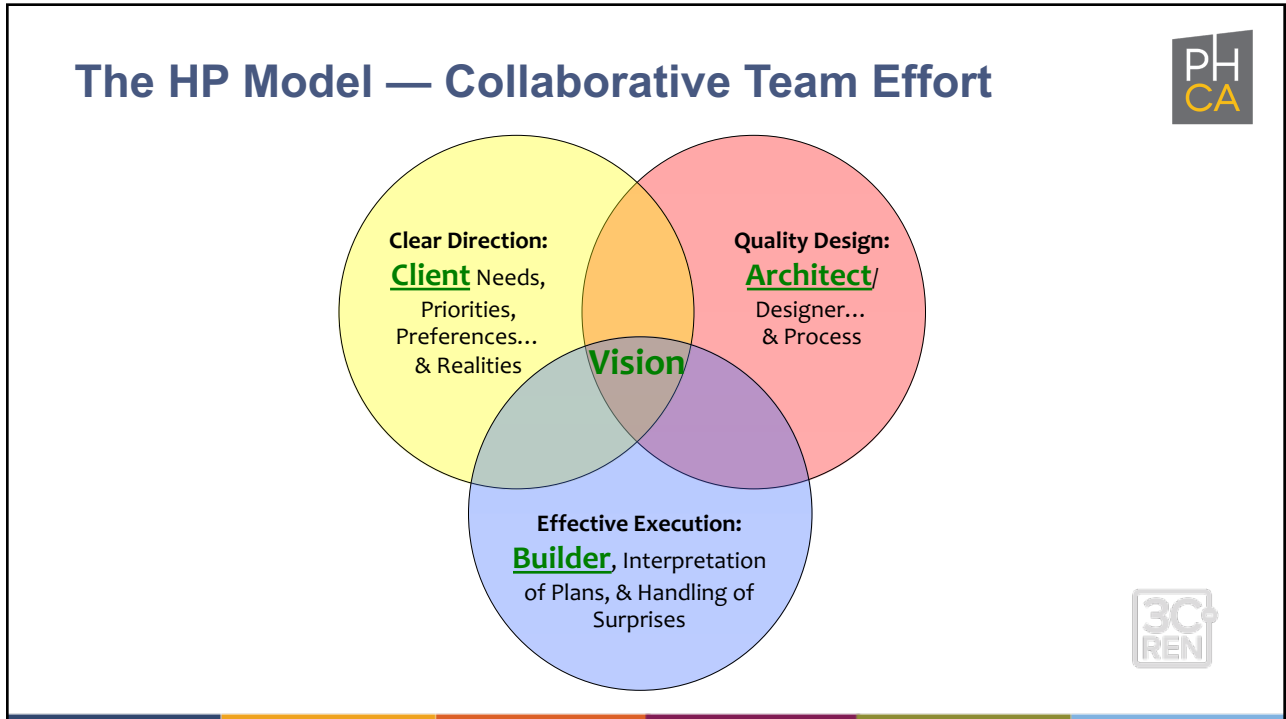


57

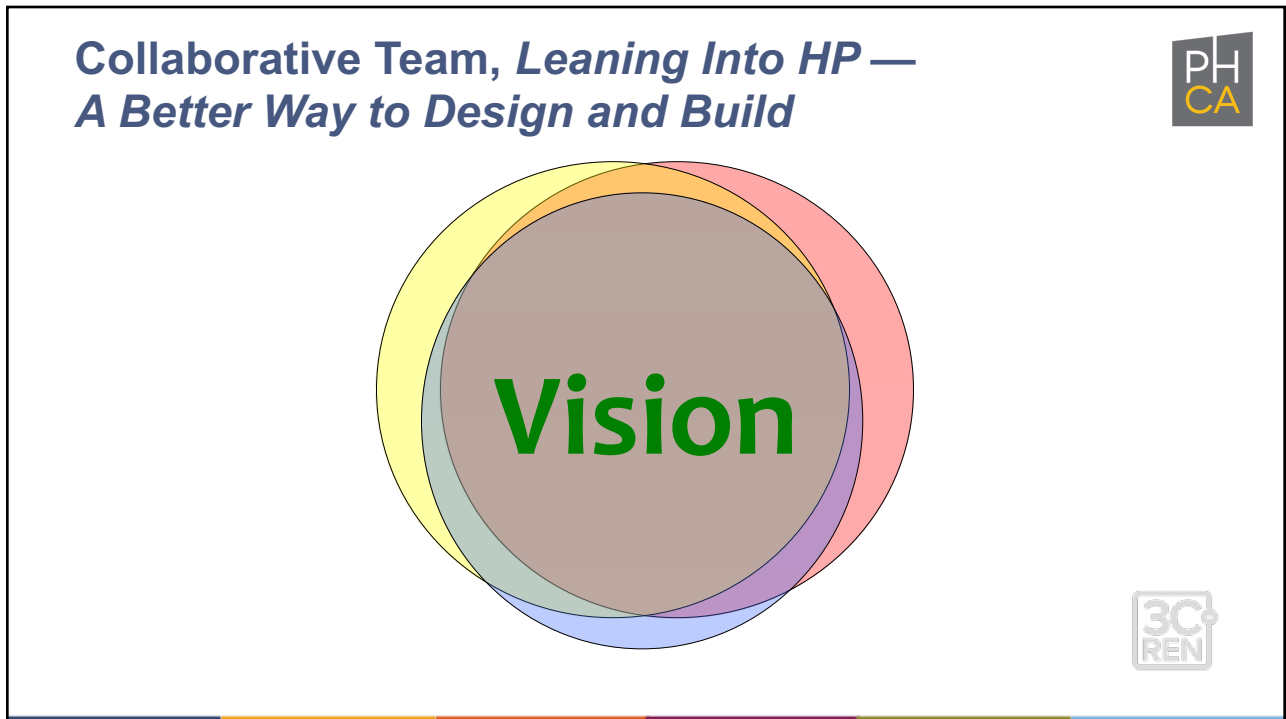
The Old Model — A Relay Race



58

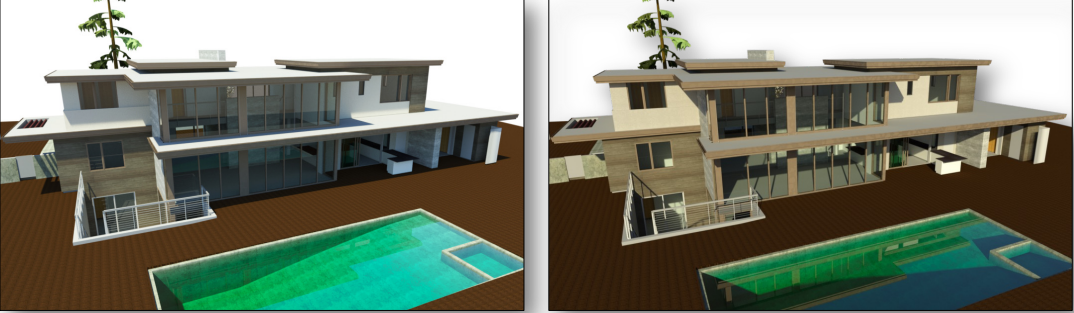



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60

Part of the Baseline




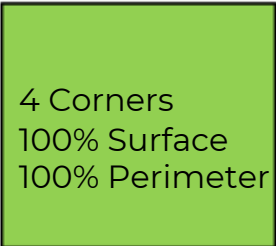
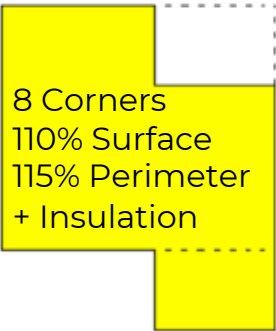
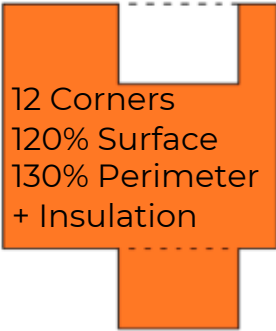
Siting and Shading



61


Part of the Baseline



 <p>4 Corners 100% Surface 100% Perimeter</p>	 <p>8 Corners 110% Surface 115% Perimeter + Insulation</p>	 <p>12 Corners 120% Surface 130% Perimeter + Insulation</p>
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Simplify the Envelope

- Minimize surface area, corners, and perimeter



62

Part of the Baseline



- Daylighting
- Fresh air
- Views
- Egress
- Airtight

Smart Window Choices



63

Part of the Baseline



Prefab Construction



Cross Laminated Timber (CLT)

Requirements and Possibilities



64

A
B C G

Upgrade to High-Performance

"We prefer to incorporate HP, but..."





Code Compliant  High-Performance

Choices lead to what is essentially – paying a premium?







65

A
B C G


High-Performance as the Baseline

Make Choices rather than Pay Premiums

State of the Science Performance  Reduced Performance, but above Pass/Fail or Minimum Standards

Energy Efficiency... Reduced Cost of Air Quality... Thermal Comfort...
Resilience... Durability... Resale Value... Peace of Mind




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Monthly EpiPHany

Position High-Performance as the Baseline


You cannot discern how a building will perform by appearance alone.


Selling high-performance as an *upgrade* —
“Would you like to add elements of high-performance?”





Code-compliant (barely legal)  High-performance (21st-century)

Start with high-performance as the *baseline*?
“Which elements of high-performance would you like to give up?”



High-performance  Barely legal



67

High-Performance as the Baseline



- Evolution of High-Performance in Buildings
- Single-family and small buildings
- **Multifamily and large buildings**
- Call to Action



68



**PH
CA**

**Passive House
High-Performance
is Scalable**



**3C
REN**

69

This slide features a graphic with a bar chart showing five bars of increasing height from left to right, with a large blue arrow pointing upwards and to the right, symbolizing growth and scalability. The text 'Passive House High-Performance is Scalable' is prominently displayed. The PH CA logo is in the top right, and the 3C REN logo is in the bottom right. A small number '69' is located below the 3C REN logo. The main image is an architectural rendering of a modern, multi-story building with a mix of brick and wood paneling, set against a twilight sky.

69



**PH
CA**



**3C
REN**

This slide shows an aerial architectural rendering of a large, multi-story building complex. The building features a facade of vertical wood slats and brick. A central courtyard with greenery and a walkway is visible. The PH CA logo is in the top right, and the 3C REN logo is in the bottom right.

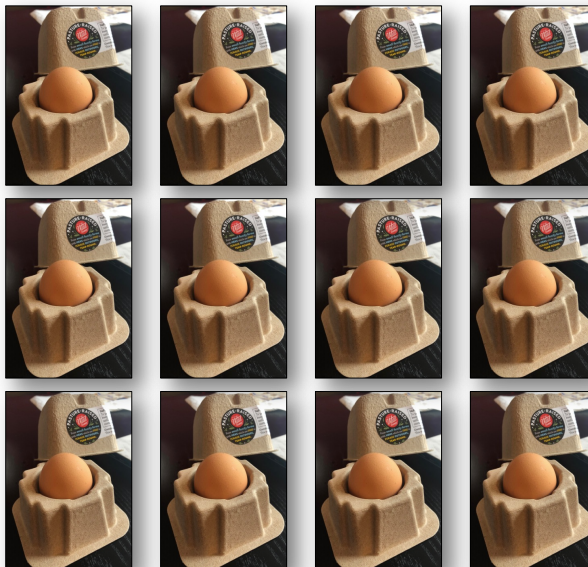
70

Safe and Comfortable for a Single Family



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Safe and Comfortable for Multifamily



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Safe and Comfortable is Cheaper by the Dozen



73

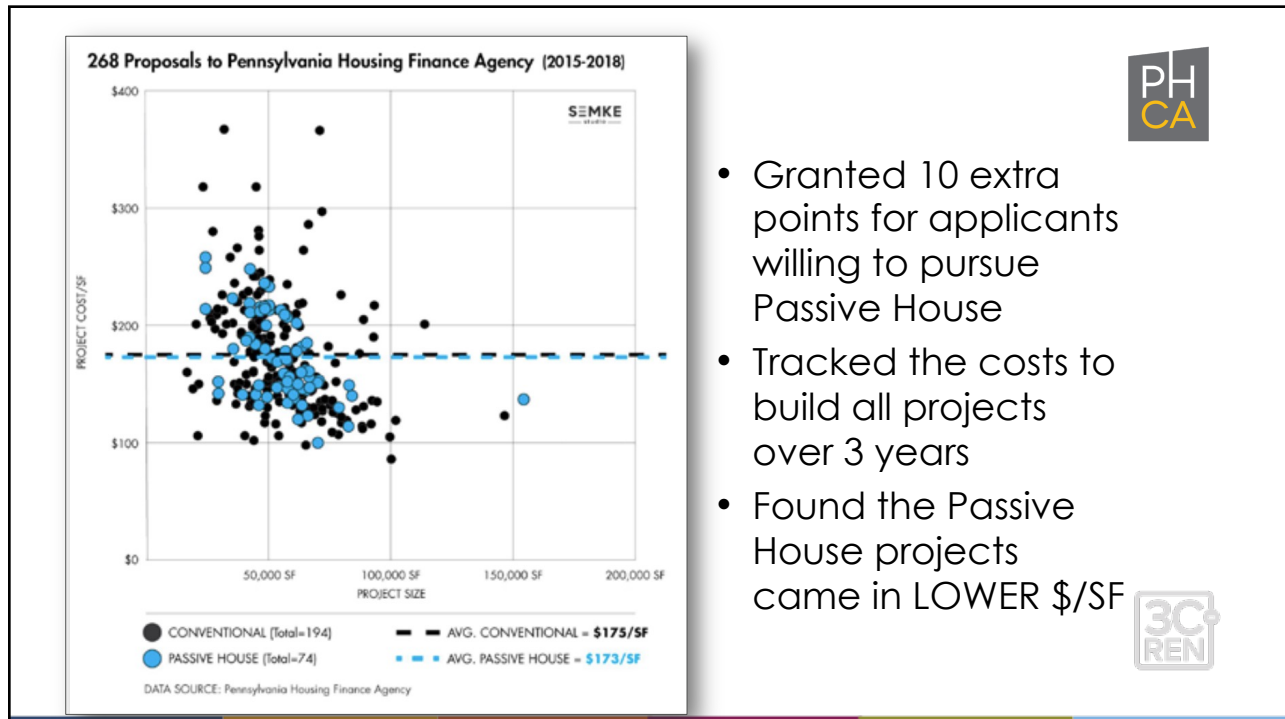
73

Code versus Passive House for Affordable Multifamily

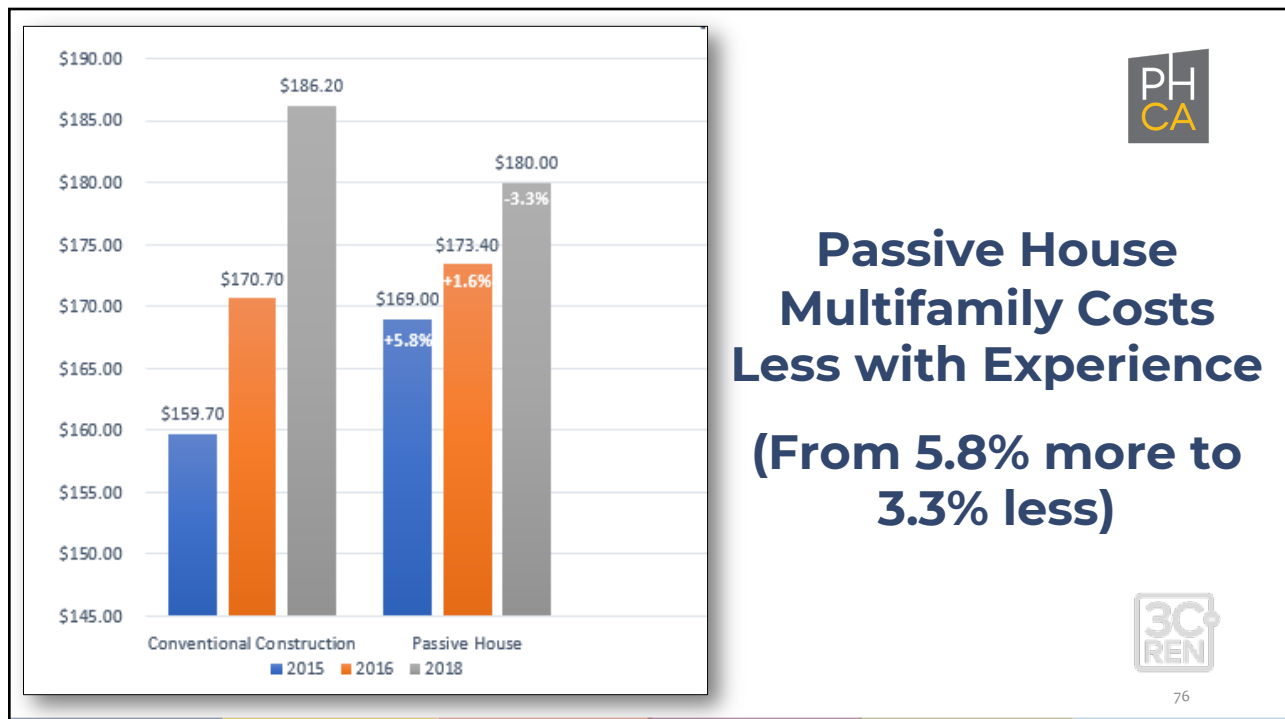
- Code Compliant airtightness, insulation, ventilation and components versus PH
 - Reduce Operational Energy by up to 70% (50% \pm in CA)
 - Reduce Unwanted Airborne Pollutants and Allergens by up to 95%
 - Investment to Design and Build \pm 5%



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For the People – For the Planet




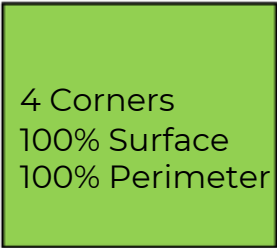
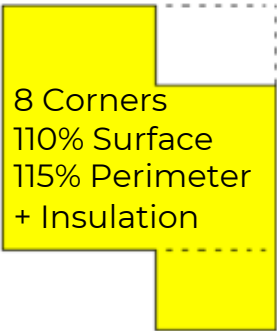
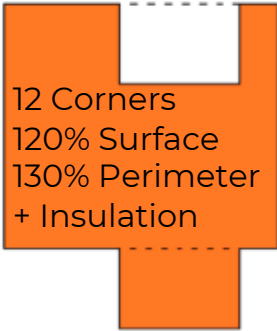
The Question is not Why? It is WHY NOT?



77


Part of the Baseline



 <p>4 Corners 100% Surface 100% Perimeter</p>	 <p>8 Corners 110% Surface 115% Perimeter + Insulation</p>	 <p>12 Corners 120% Surface 130% Perimeter + Insulation</p>
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Simplify the Envelope

- Minimize surface area, corners, and perimeter



78

Decorate the Envelope, Not with the Envelope

Too many teams design from “outside in” and use windows to decorate. Every window should provide one or more of the following functions:

- Contribute to daylighting
- Access a desired view
- Provide ventilation (when weather and outdoor air quality allow)
- Serve as egress

The cost premium is not just the cost of the window... it includes the cost of quality installation, and the cost in terms of diminished performance

If a window does not serve a specific purpose, then it is a detriment to high performance and a cost premium



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The envelope: decorate it ... but not with it!



80




The New Baseline — Evidence Based Performance





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Monthly EpiPHany

Three Tips for Achieving High-Performance Buildings




Today, “High-Performance” generally refers to: Maximum Energy Efficiency; Physical and Emotional Comfort; Healthy IAQ; Resilience; and ultimately, Zero Net Energy; Zero Net Carbon. The Passive House Planning Package (PHPP) and the recently introduced PH Ribbon (integrates embodied carbon) make it possible to deliver the owner’s targets for high-performance. The *three-legged stool* of [Early planning](#), [Envelope first](#), and [Aspirational goals](#) are critical to achieving desired performance on time and on budget with minimal surprises.

Early planning — You may remember the MacLeamy Curve from an earlier EpiPHany, [Effort Curve](#). When you select your team and invest in planning, modeling, and budgeting early, you enable maximum functional capabilities with minimal cost.

Envelope first — The airtightness, climate specific strategic insulation, and detailed thermal bridge analysis associated with Passive House are foundational to achieving high-performance buildings. Making decisions and developing specifications for the envelope first provides significant benefits for the project.

Aspirational goals: When contemplating performance goals for a new building/project, or for a renovation or retrofit, we often limit our thinking to a list of performance related tactics or the expected budget. It is far more effective to approach from a big picture perspective and consider what is potentially possible.

These three tips will help you identify and achieve the high-performance goals appropriate for your project. They will also reduce false starts and surprises, increase collaboration, and minimize additional investment required to reach desired levels of performance. Achievable high-performance is the logically appropriate baseline.



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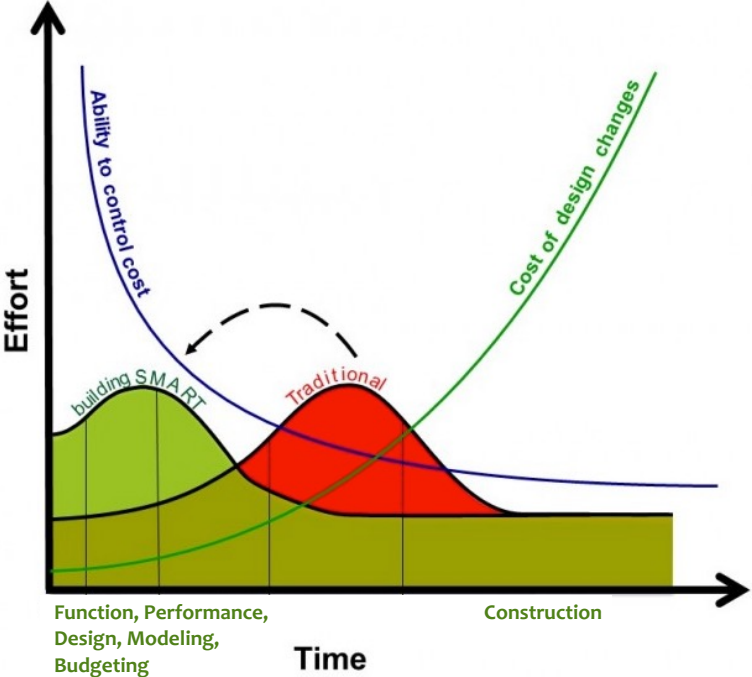
“Evidence Based Performance”


- Set Performance Goals & Measurement Methods
- Employ Detailed Modeling
- Testing/Commissioning to Verify Performance
- Monitor Performance and Occupant Experience





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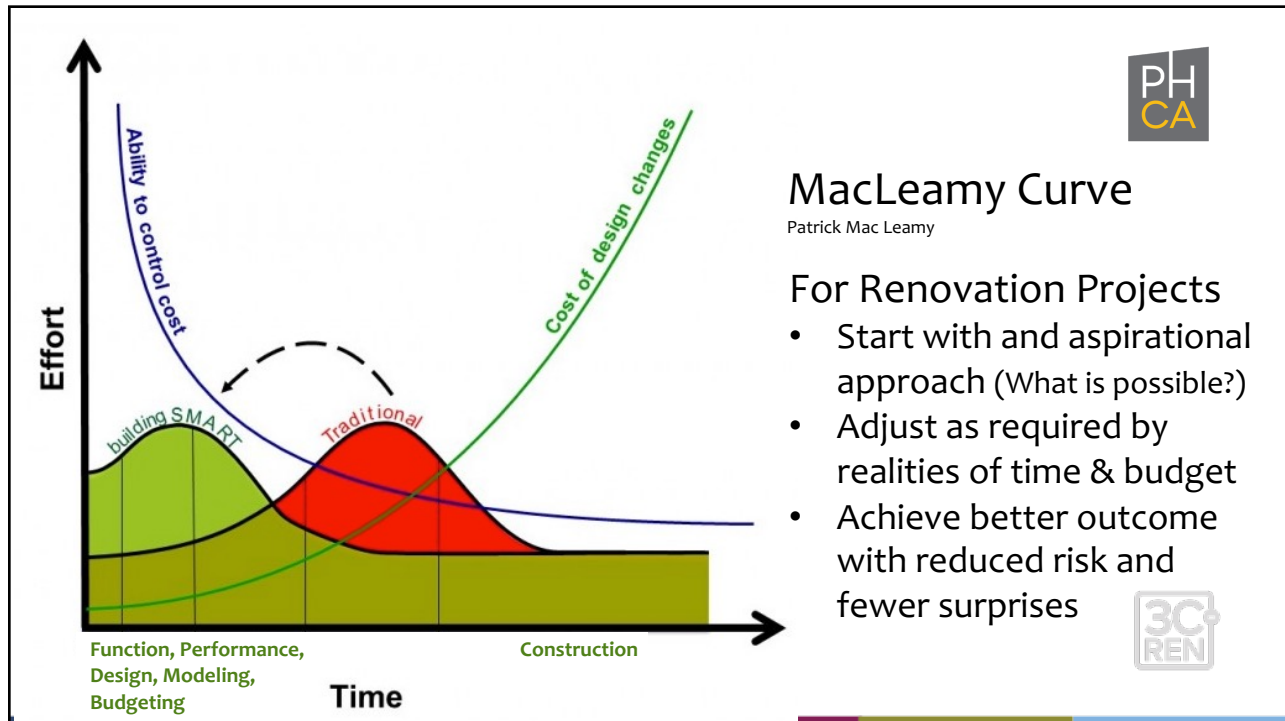
MacLeamy Curve

Patrick Mac Leamy

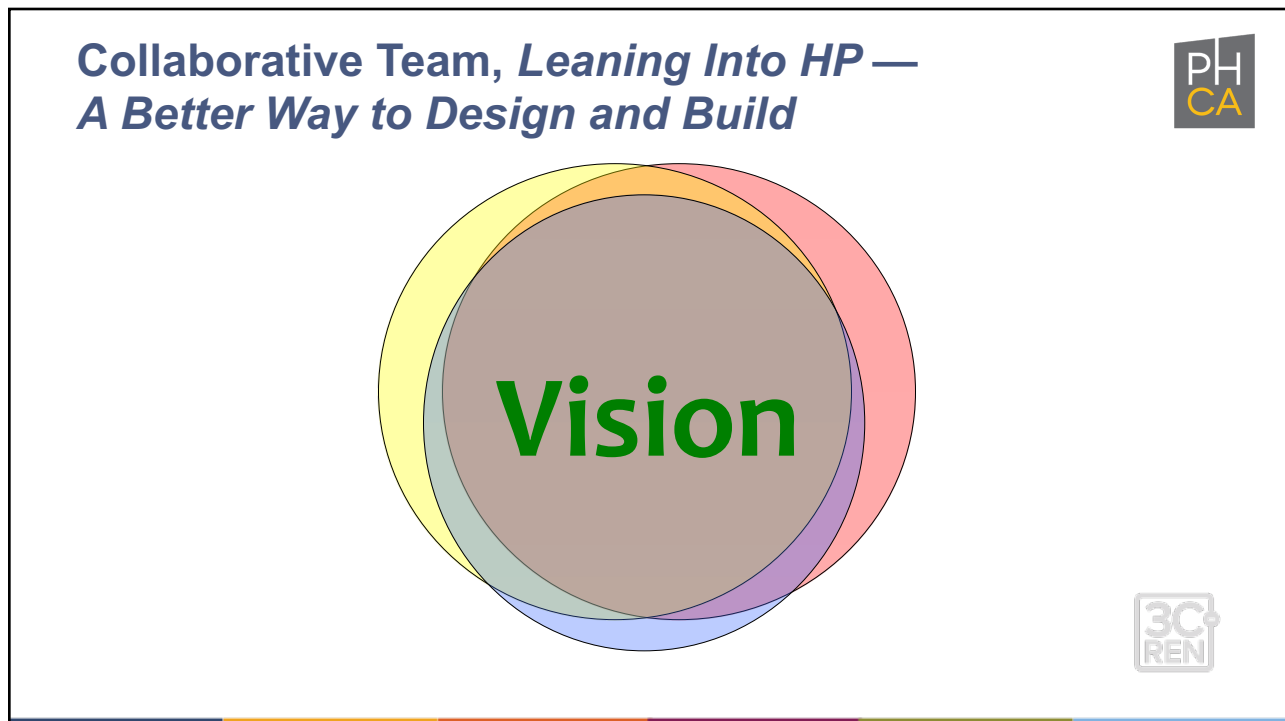
- Begin with the End in Mind
 - Performance Goals
 - Measurement Methods
- Detailed Modeling — and Iterative Budgeting
- Enable Early Decisions
 - High Control / Low Cost
- Inform Value Engineering



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85



86

Therefore: engage key people EARLY



ARCHITECT /
DESIGNER

MAJOR
CONSULTANTS
& SUBS



BUILDER /
CONTRACTOR

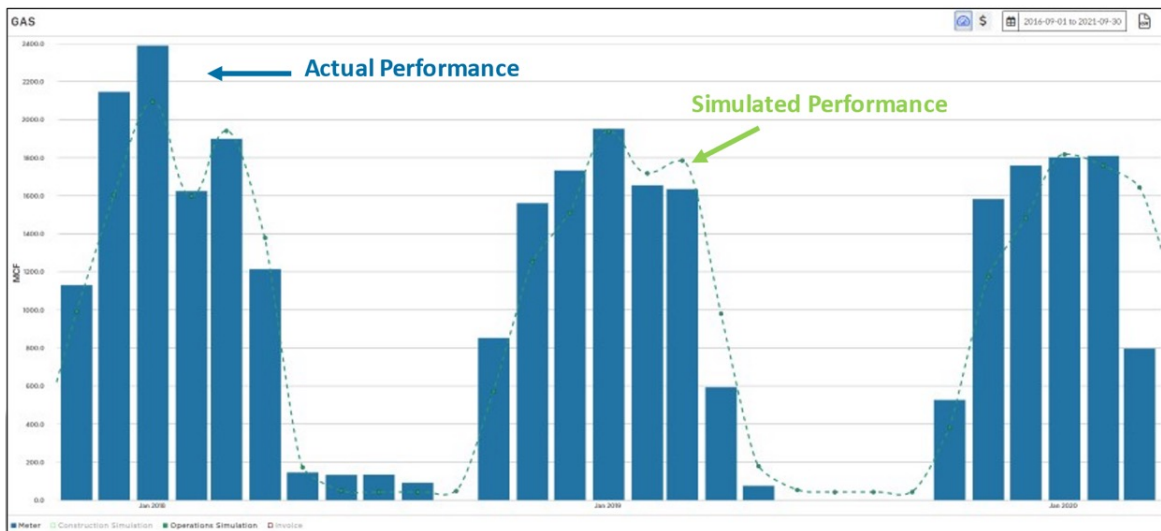
All should have experience on projects comparable in **NATURE and SCOPE**



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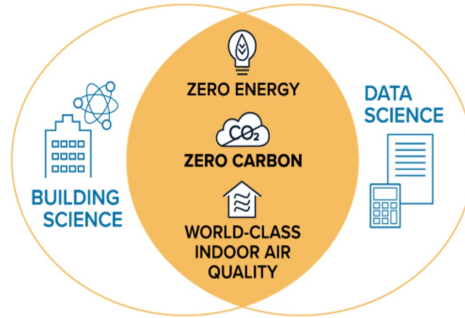
Predictive Performance

How builders know they got what they paid for



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The key building science enabler to affordable ZNE/ZNC & healthy IAQ is Passive House



The key data science enabler to evidence-based performance is physics-based modeling and simulation

Integration of Passive House Standards

- The standard that **most affordably enables energy efficiency, healthy indoor air quality, and resilience** is Passive House.
- Passive House standards deliver the most aggressive reduction of energy consumption, making the path to zero energy and zero carbon **more predictable and less risky**.
- The integration of Passive House **works synergistically with other standards** because PH is more stringent **and sets a bar higher in terms of energy efficiency, healthy indoor air quality, and resilience**.



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Football Team

- Qualified, **high-performing players** at every position
- A **playbook** that integrates the positions and actions of each player to **work together as a team** and run plays **to achieve specific objectives**
- **Game plan** to play offense and defense to **get a desired outcome against a specific opponent**

Design/Build Team

LEED and Cal Green

- **Point accumulation** to reflect required or desired levels of sustainability **within each of multiple categories**

Passive House

- **Passive House Planning Package (PHPP)** integrates all elements into a predictive model that **forecasts specific performance**
- PHPP iterations enable **informed choices to achieve cost effective desired performance of a building**



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High-Performance as the Baseline



- Evolution of High-Performance in Buildings
- Single-family and small buildings
- Multifamily and large buildings
- **Call to Action**

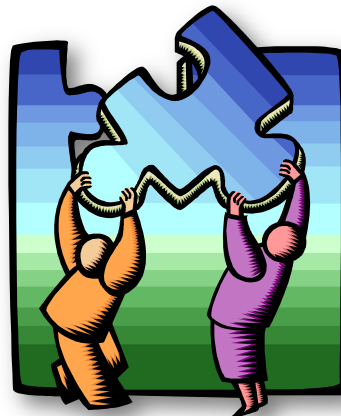


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Steps to Success for PH



- Identify the Leaders
- Set Higher Targets
- Support Front Runners
- **Educate Everyone**
- Remove Barriers and Increase Incentives
- **Pilot Projects**



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Educate Everyone



- Do you know of any organizations or groups that might benefit from learning more about the Building Blocks of High-Performance?

Need a presentation?

Reach out to:

info@passivehousecal.org



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Potential Pilot Projects



- Are you aware of, or do you have any ideas for, Pilot Projects currently being planned or on the horizon?

Perhaps we can help

Reach out to:

info@passivehousecal.org



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Personal Opportunities



- Take Passive House Training
NAPHNetwork.org (3C-REN)
 - Join Passive House California
 - Individual Professional Membership
 - Organization/Company Membership
 - Sponsor
 - Donor or Volunteer
- passivehousecal.org



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Be the Difference.



Jay Gentry
Jay.gentry@passivehousecal.org
(831) 320-8538

***Thank You for Your
Time and Attention***



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Closing

- Continuing Education Units Available
 - Contact ian.logan@ventura.org for AIA LU's
- Coming to Your Inbox Soon!
 - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
 - Shifts in Power: Ensuring the IRA, 2022 Energy Code, and California Climate Policies Benefit the Tri-County Region (11/9 SLO)
 - 2022 Energy Code Preview for Single Family Projects (11/10)
 - Home Assessments for Decarbonization (11/15)
 - Blower Door Basics and Beyond (11/16)
 - 2022 Energy Code Preview for Multifamily Projects (11/17)



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Thank you!

For more info:
3c-ren.org

For questions:
info@3c-ren.org



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