

The Building Blocks of Passive House Performance

Speaker



Jay Gentry

- Graduate of UCLA Business School
- USAF Instructor Pilot
- Marketing and Sales Consultant
- Passive House California Board of Directors
- Passive House – A Workable Solution Initiative



Webinar Logistics

- All attendees are in listen only mode
- We will be answering questions after the presentation
- Please send us questions using the Q&A or chat box at any time
- The webinar is being recorded and will be shared after the webinar



SCP's Mission

Sonoma Clean Power is turning the tide on the climate crisis, through bold ideas and practical programs.

- Provide higher percentages of renewable energy and reduce greenhouse gas emissions
- Help solve the climate crisis at a local level
- React and respond to local needs
- Deliver customer programs that make a difference



Sonoma Clean Power Advanced Energy Center

- Explore the future of clean energy for your home.
- Featuring a large demonstration area, you can learn about a variety of options, including induction cooktops and heat pump water heaters.
- Compare products. Learn about benefits. Attend classes—there's even an educational space for kids of all ages.



Now open!

741 4th Street, Santa Rosa

www.scpadvancedenergycenter.org

Customer Benefits

- Get specially negotiated discounts on:
 - Heating & Cooling
 - Induction Cooktops
 - Water Heating
- Learn about emerging technologies
- Get connected with certified installers

Brands

 AO Smith

 BOSCH

ecobee


JENNAIR

 LG

 MITSUBISHI
ELECTRIC

 Rheem

 SANDEN



0% Financing. 100% Easy.

- SCP is offering 0% financing for select energy-efficient technologies.
- Payable through your utility bill!
- Financing of up to \$10,000 is available for residential customers in Sonoma and Mendocino counties.
- To learn more or to get started, please visit

scpadvancedenergycenter.org/financing

 **Sonoma Clean Power**
Advanced Energy Center

The Building Blocks of Passive House Performance

Jay Gentry – Passive House California
July, 2021



The diagram illustrates the building blocks of Passive House Performance. It features a sequence of icons and text: a house icon labeled 'Passive House', a plus sign, a tree icon labeled 'Low Embodied Carbon', a plus sign, a lightning bolt icon labeled 'Electrify Everything', a plus sign, a sun icon labeled 'Clean Energy', an equals sign, and a globe icon labeled 'Climate Action'.

1

The Natural Order of Decarbonization & Sustainability

Jay Gentry – Passive House California
July, 2021



The diagram illustrates the natural order of decarbonization and sustainability. It features a sequence of icons and text: a house icon labeled 'Passive House', a plus sign, a tree icon labeled 'Low Embodied Carbon', a plus sign, a lightning bolt icon labeled 'Electrify Everything', a plus sign, a sun icon labeled 'Clean Energy', an equals sign, and a globe icon labeled 'Climate Action'. The 'Passive House' icon is circled in white.

2

Thank you for the Opportunity



Jay Gentry

- Graduate of UCLA Business School
- USAF Instructor Pilot
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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.



5

Evidence-based Reality

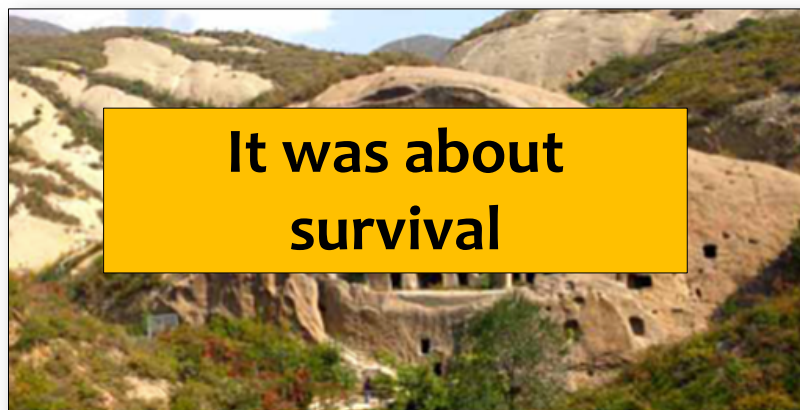


- The Climate Crisis is real
- Driven by GHGs from human activities
- Operational carbon from the built environment is a major contributor
- Unprecedented action is required... now, and into the future
- We must minimize the energy required, electrify everything, and shift the source of that energy to renewables
- Passive House protocols are part of the solution



6

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



8

Intelligent and Purposeful Choices



Over time we shifted from human energy to electrical energy — largely produced by burning fossil fuels



9

Intelligent and Purposeful Choices

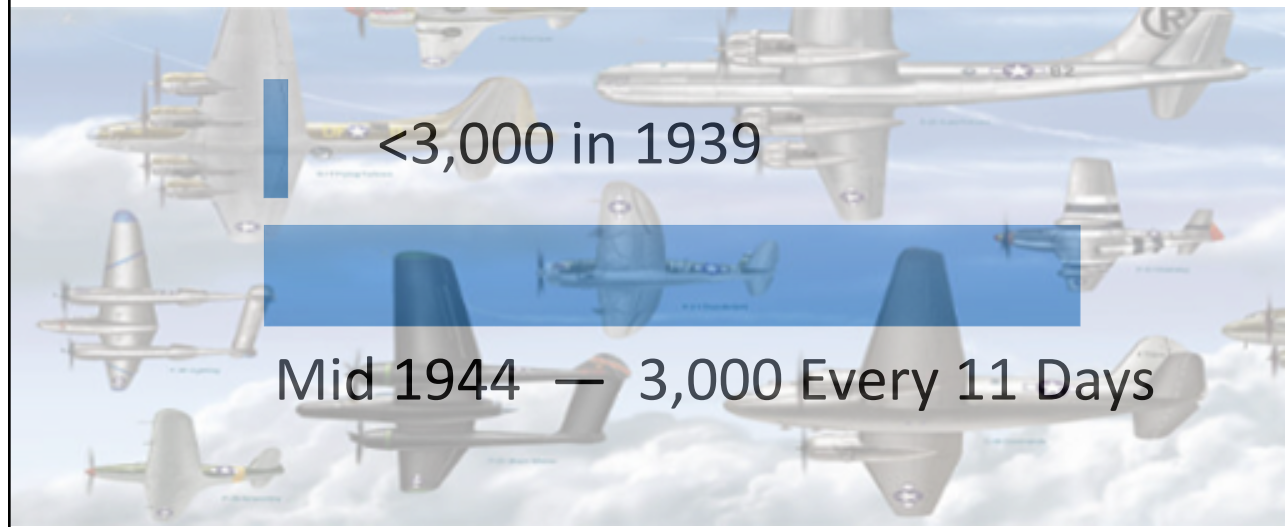


Today's challenges: Maintain and enhance the benefits with dramatically less energy — (and shift the reduced demand to renewable energy)



10

“Unprecedented Action” US Production of Military Aircraft



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Passive House



The world’s most
aggressive energy
efficiency standard for
buildings

“The United Nations endorsed Passive House as a global standard at the recent North American Passive House Network conference... Deputy Secretary-General Amina J. Mohammad described Passive House as a model for the developing world... and the developed world”

Originally published on the EcoReport (2017)



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Passive House



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O'Neil Passive House



Sonoma, CA

- First Certified PH in CA
- 2001
- Retrofit 1900 – 2300 SF



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“Passive House Perfection”

- Carmel, CA – 2013 — Fine Homebuilding Magazine’s “Best New House of 2013”



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Sol Lux Alpha San Francisco 2018



PH
CA



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Passive House Multifamily



PH
CA



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Passive House



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Passive House City Block



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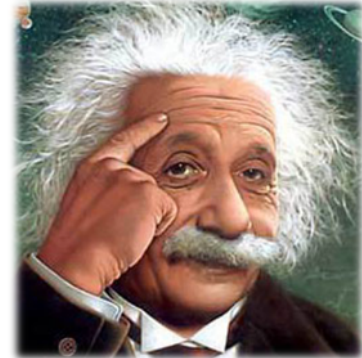
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Today's Presentation (2/2)

- Today's objective: Put you in position to make informed decisions on whether and how you can support Passive House
 - AHAs, Nods... Yes, that makes sense
 - Given the opportunity, I would be a supporter of Passive House, and/or the associated steps, policies, and programs that bring Passive House levels of performance to our communities



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Exponential Growth

200K SF

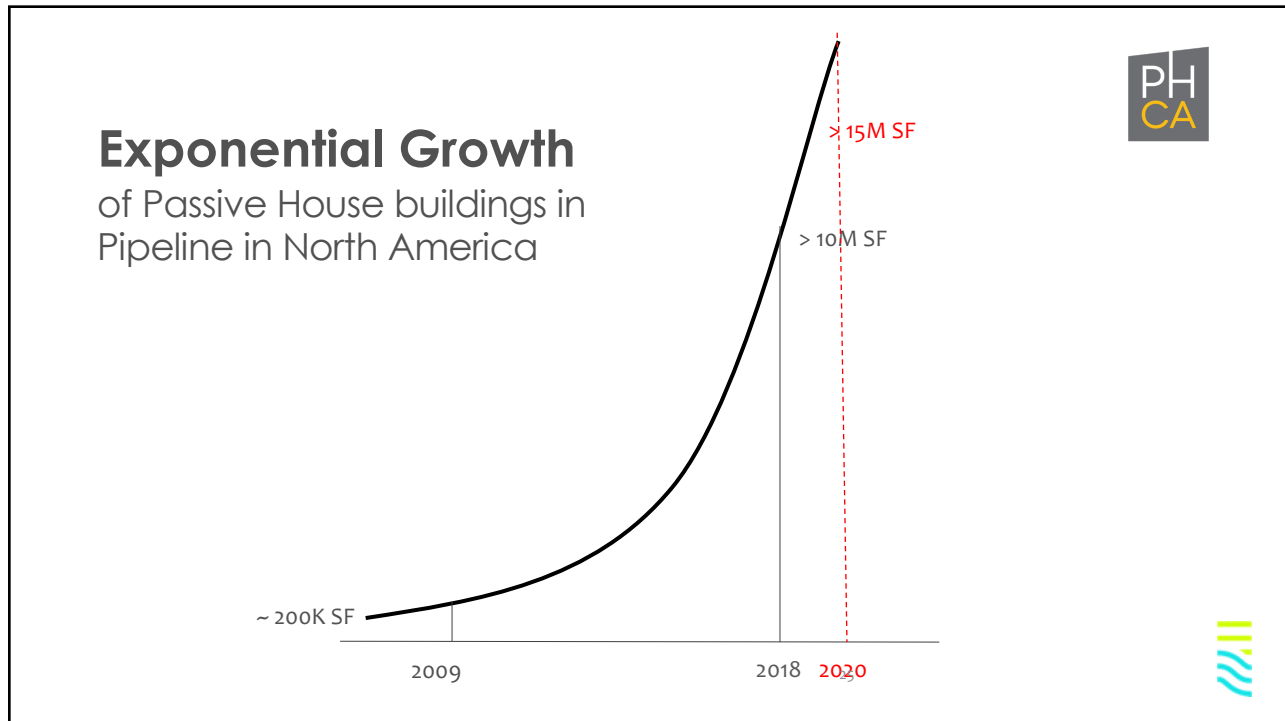
10M SF

15M SF

2009 2018 2020

Passive House has Arrived

24



25

And is Here to Stay

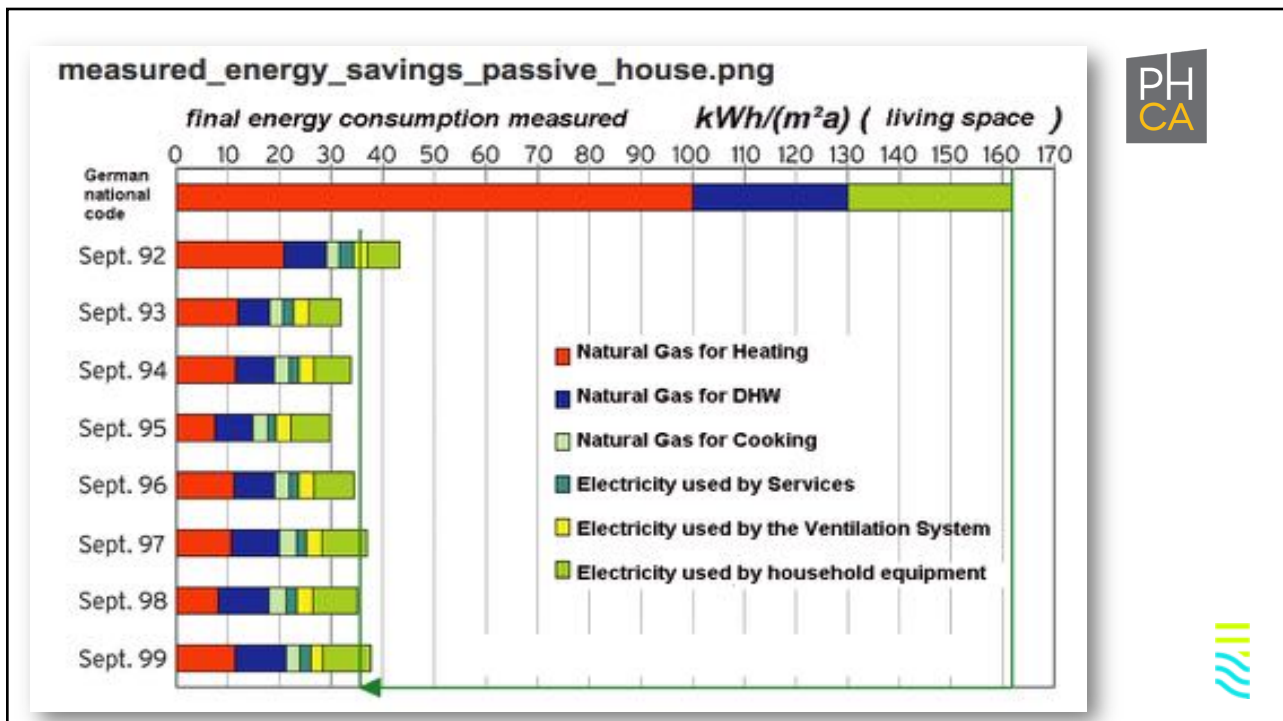
In their recent report, The Sheldon Group notes that...
“During times of crisis, fringe ideas migrate rapidly into the mainstream. It’s happening right now as we continue to respond to Covid-19. High-performance buildings in general and Passive House in particular, used to be considered fringe. They are not anymore. These days, with the climate and health challenges we face, they should be considered standard.”

9/16/20 – Lloyd Alter - TreeHugger

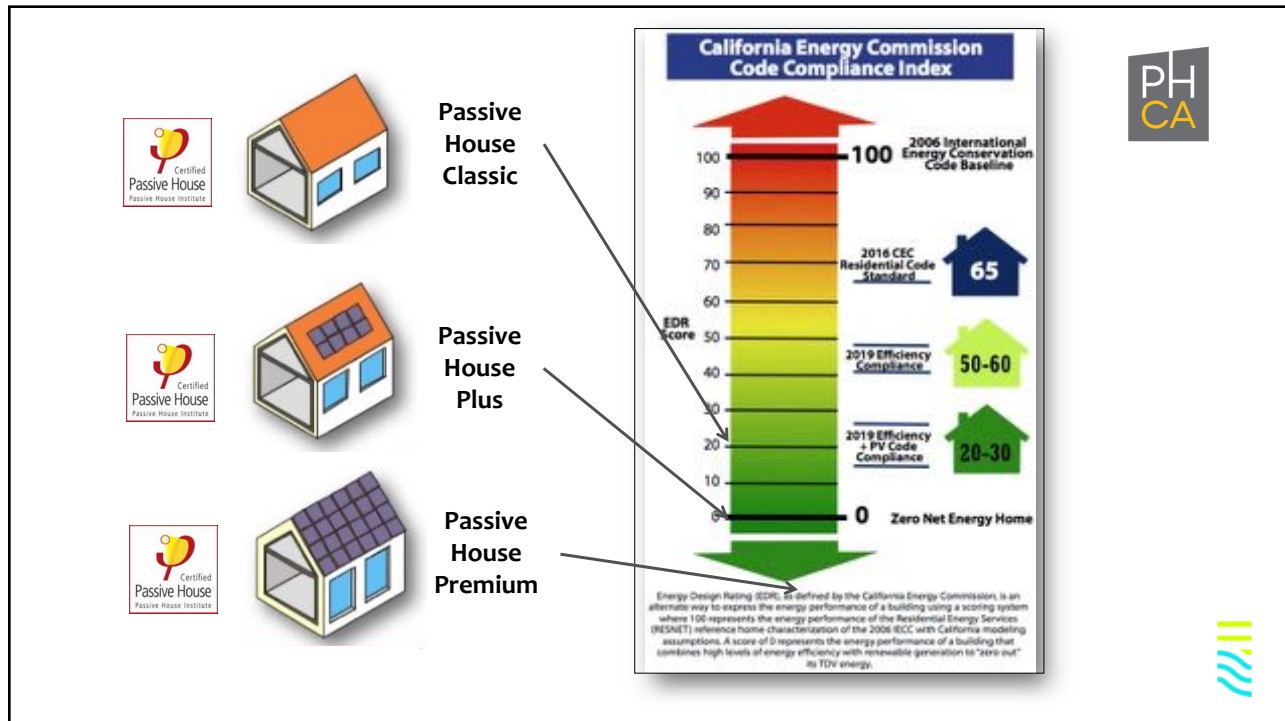
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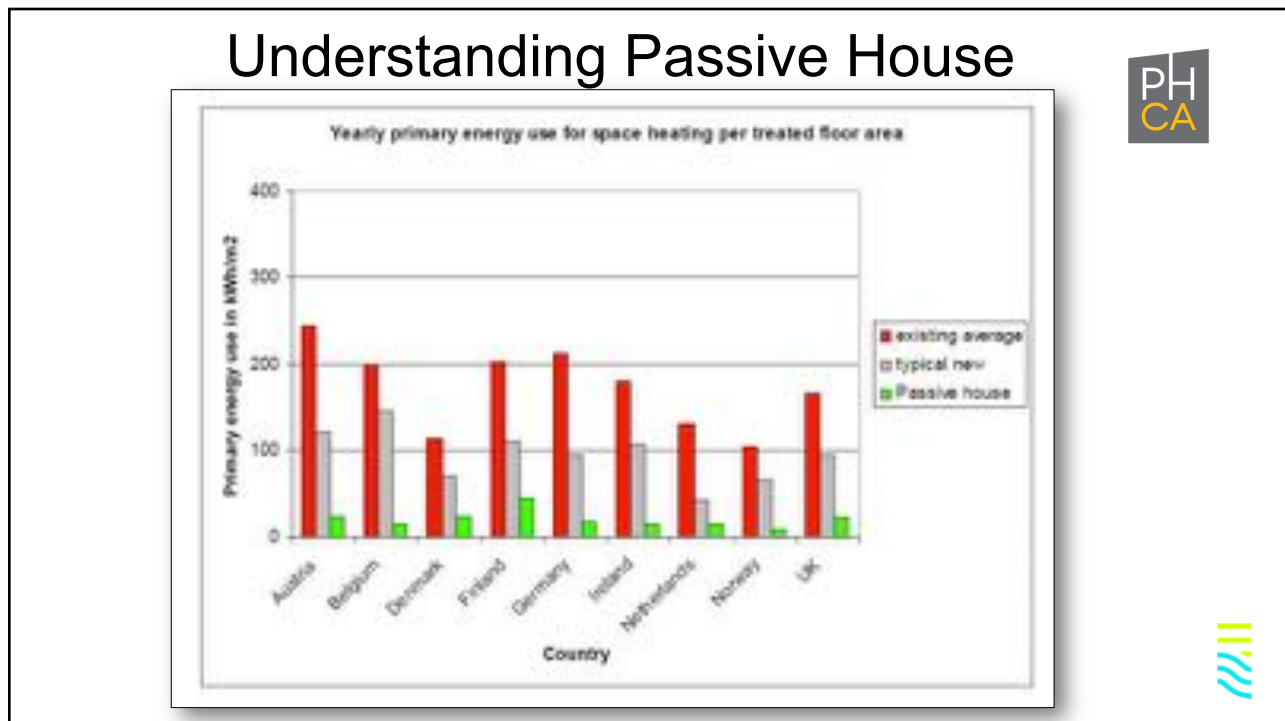
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Passive

Active

Passive House
is “Passive”

PH
CA

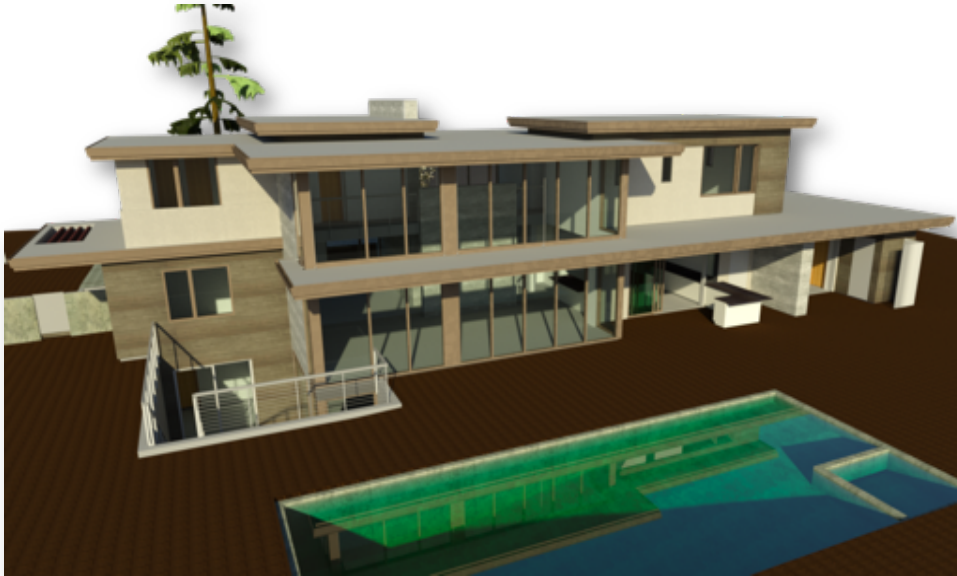
31

Summer Solstice 3:00 PM

PH
CA

32

Winter Solstice 3:00 PM



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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

34

Passive - It's In the Name



- Elegant 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



35

The wing on a race car



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Reverse angle diagonal parking



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Another Elegant Solution

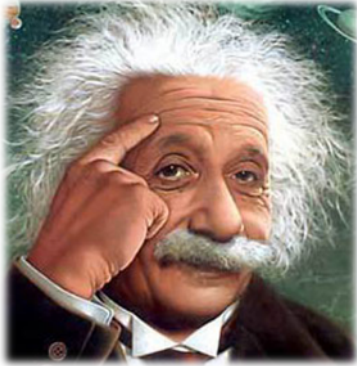


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Reduce... then Produce



- Start with Passive House
 - Achieve Net Zero with significantly less renewables
 - Use any excess to power your EV or for Electrification
 - Install a smaller battery storage system to achieve desired resilience (short/long term)

“Renewables Last”

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Passive House Efficiency



Enables this approach to Net Zero



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Renewables without Addressing Efficiency First



May require this approach to reach Net Zero



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Goal: Drive from Sonoma to Los Angeles



- Zero stops for fuel
- Even though driving a car with a bad transmission and leaky fuel line



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Goal: Drive to Los Angeles






All you need is a bigger gas tank



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How Passive House Delivers Performance



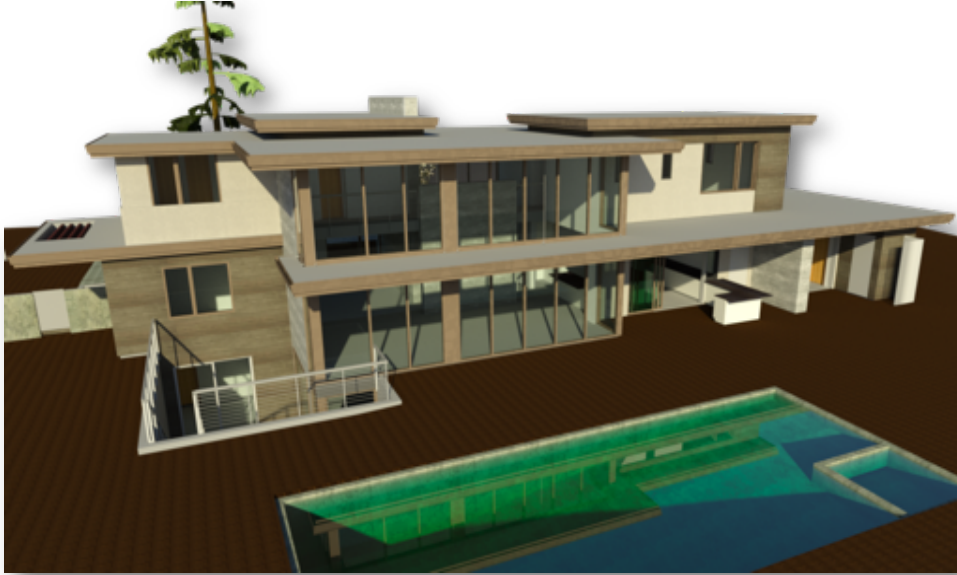
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Summer Solstice 3:00 PM



46

Winter Solstice 3:00 PM



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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**



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Passive House – The Basics

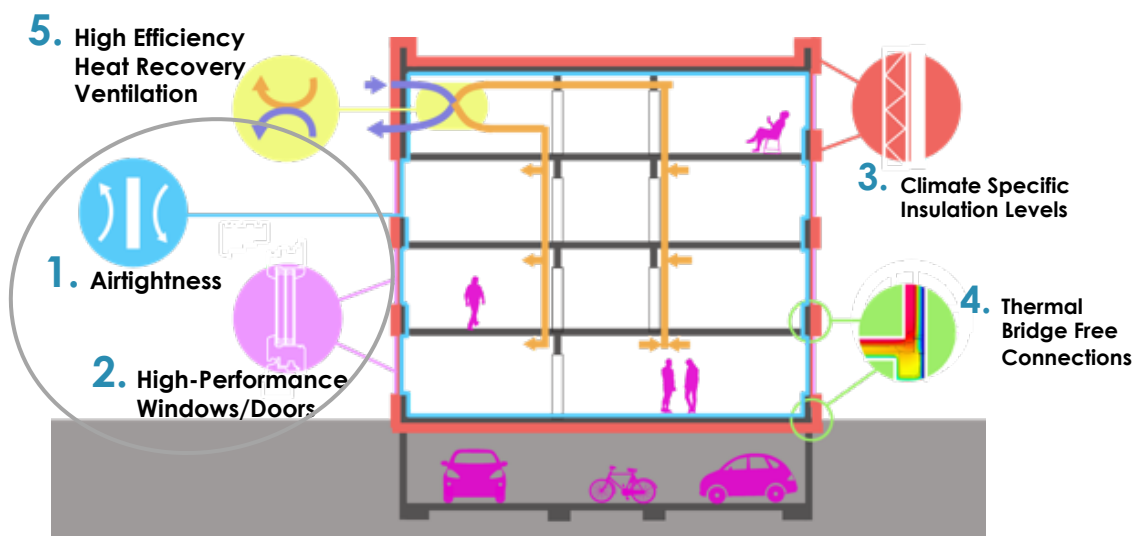


- Many elements but the the big 3 are
 - **Airtight building shell**
 - Better insulation correctly applied
 - Mechanical ventilation with heat recovery



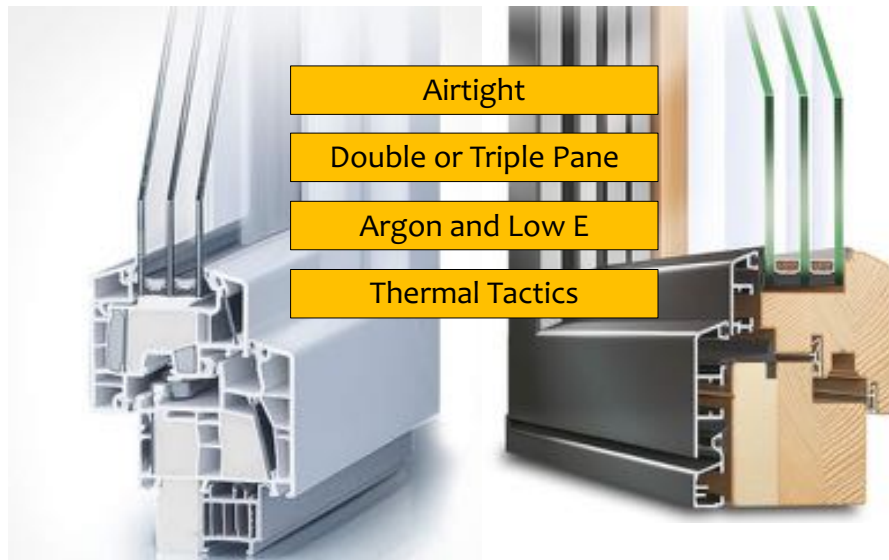
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Five Key Principles:



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High Performance Windows



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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



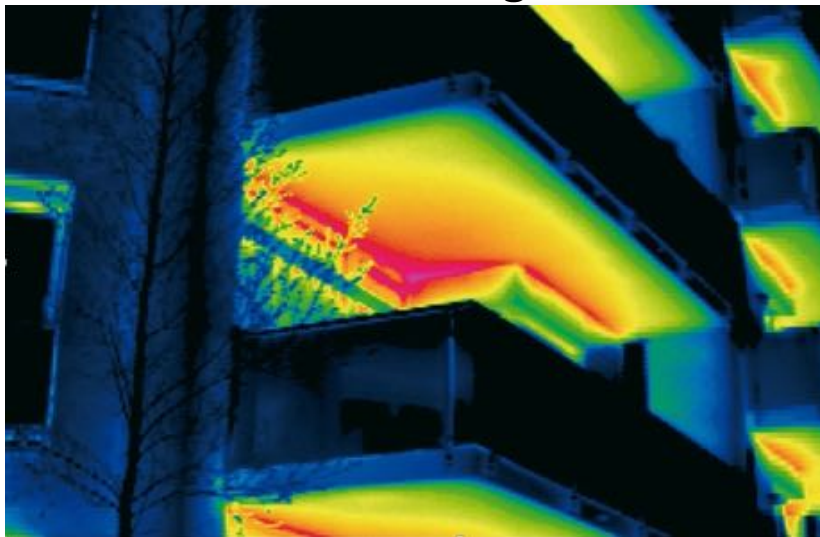
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Insulated Thermos vs. Heated Pot

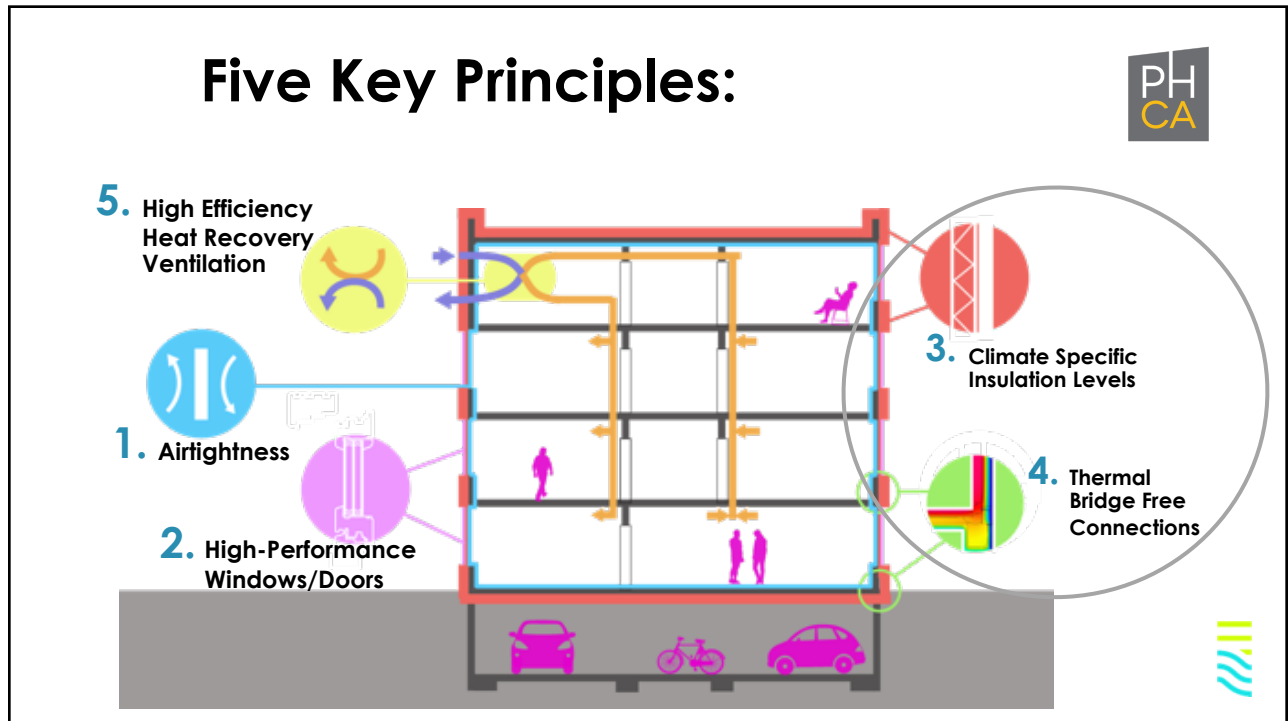


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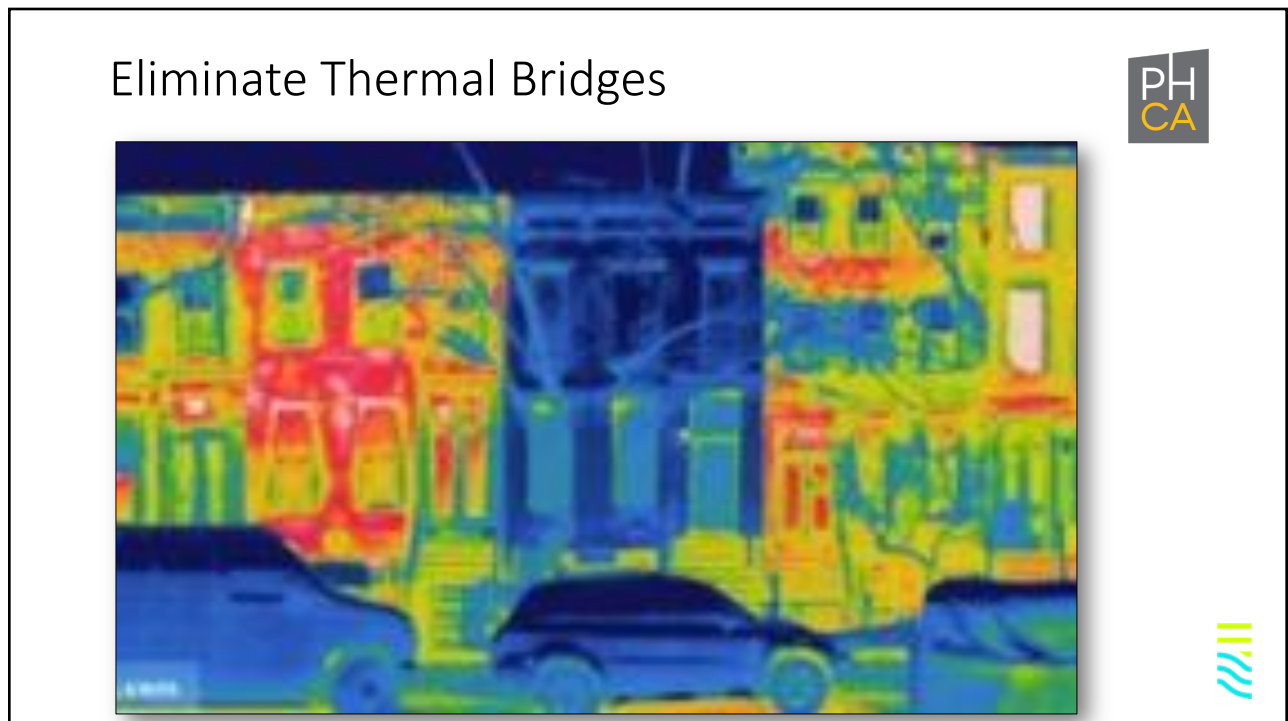
Eliminate Thermal Bridges



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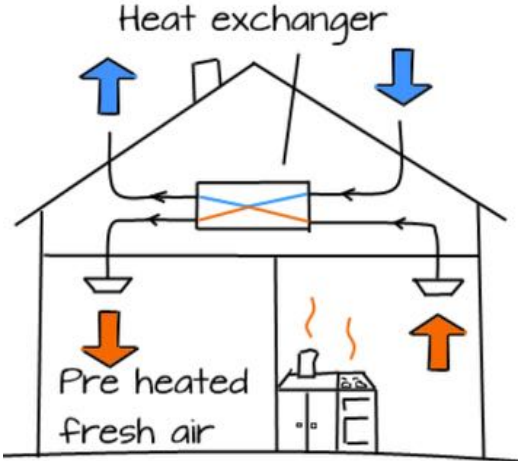



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Passive House – The Basics




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






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Five Key Principles:




5. High Efficiency Heat Recovery Ventilation




3. Climate Specific Insulation Levels




1. Airtightness

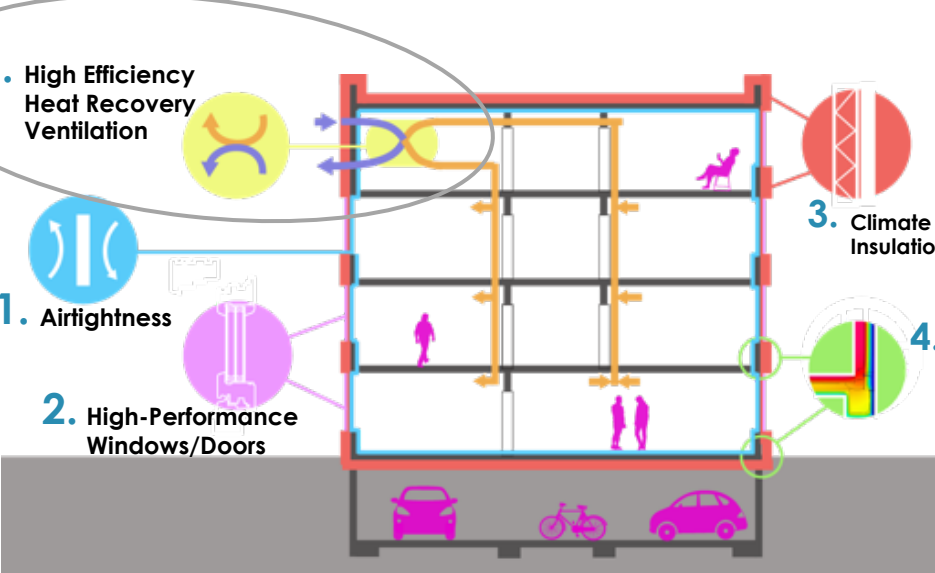



4. Thermal Bridge Free Connections



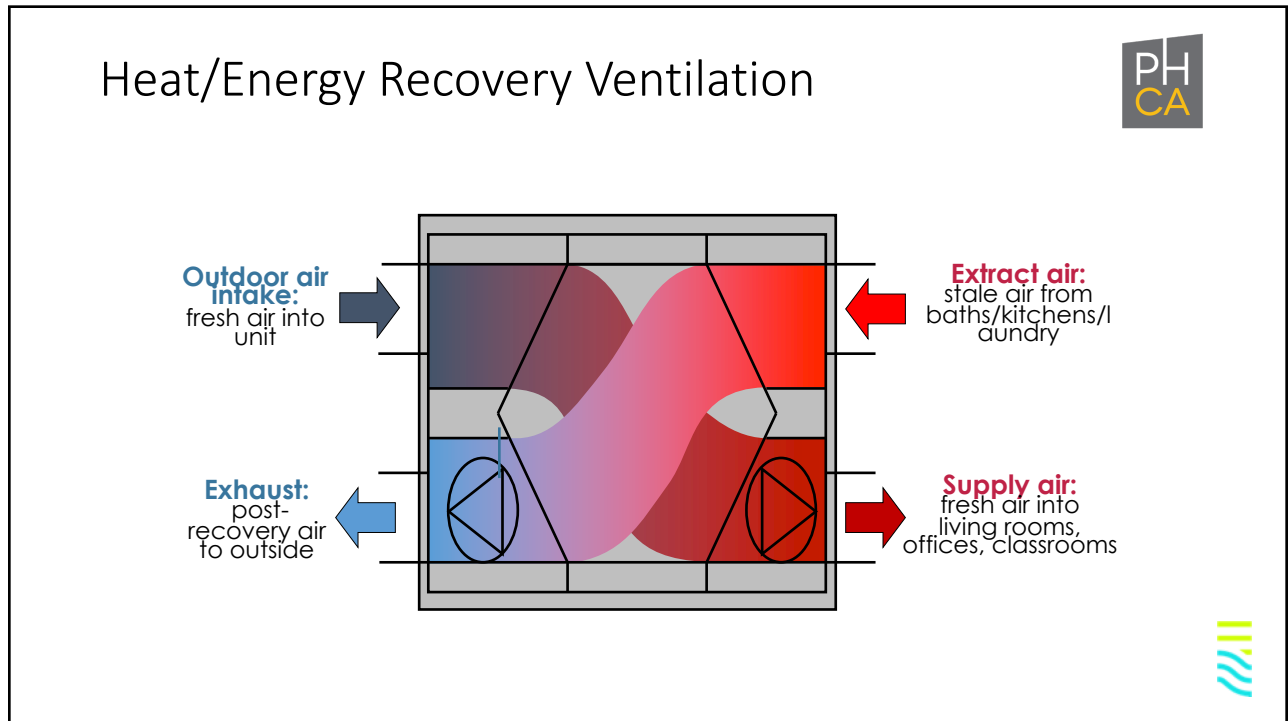
2. High-Performance Windows/Doors



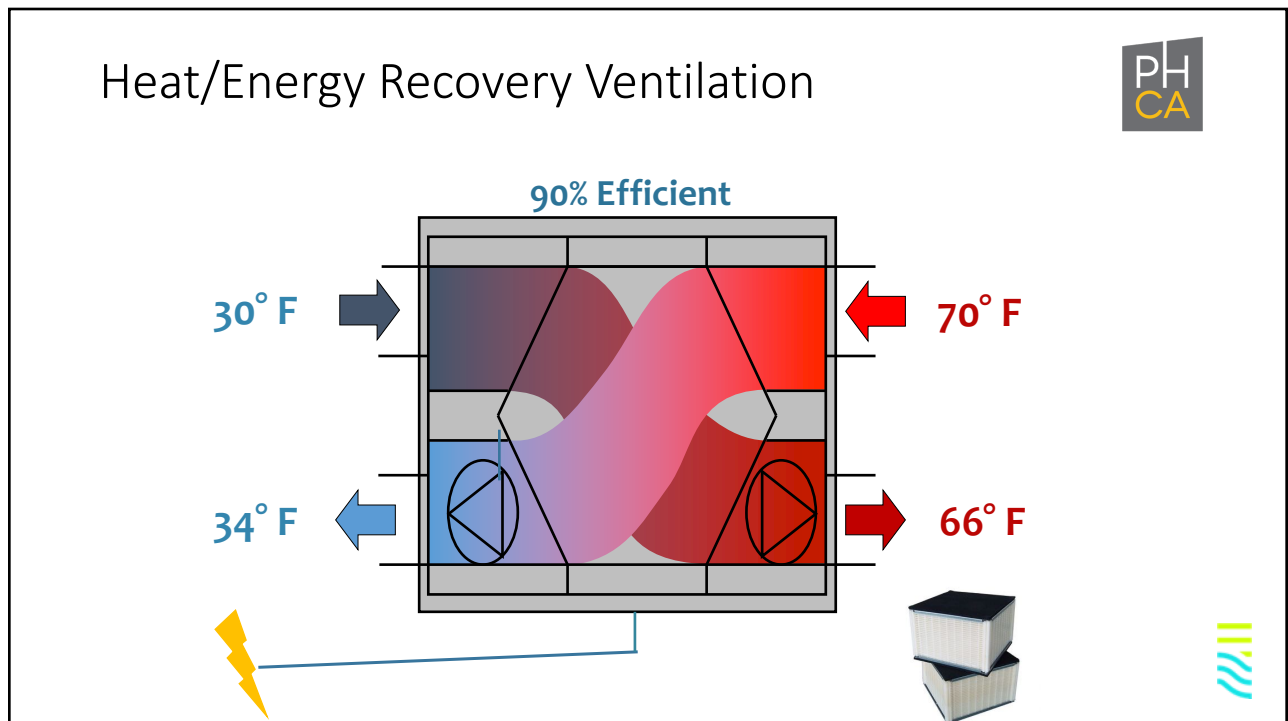




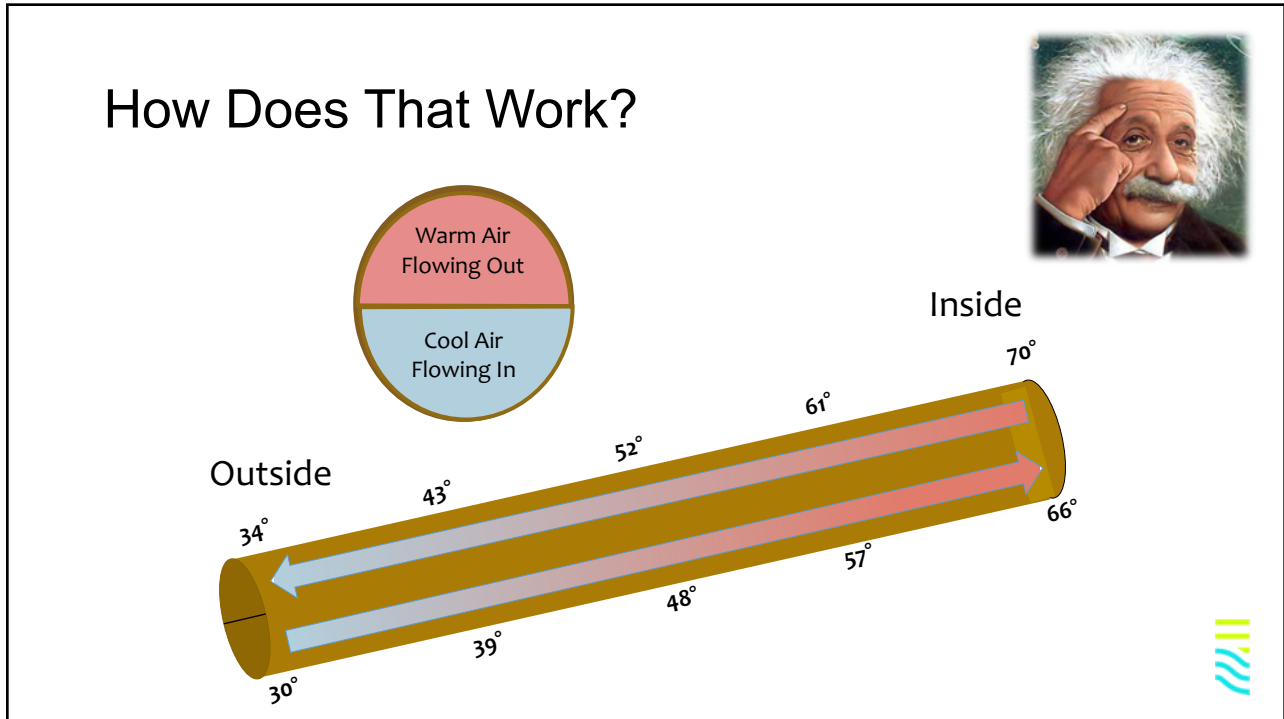
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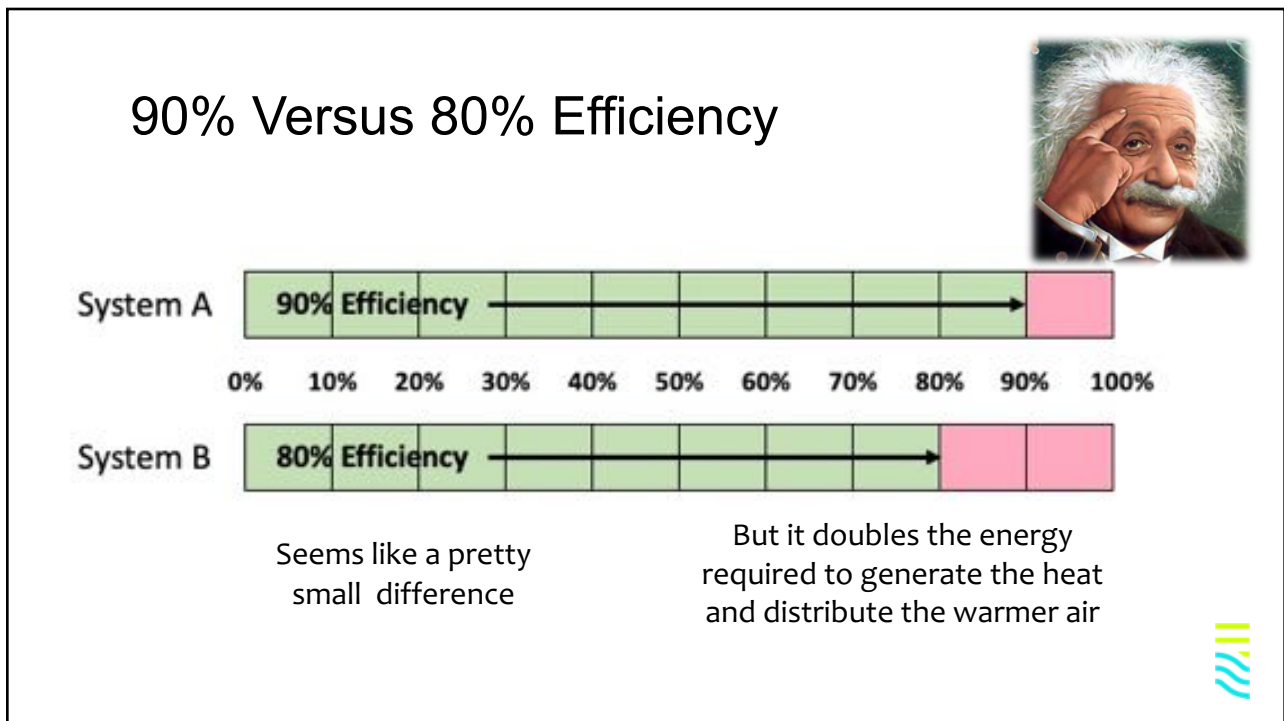
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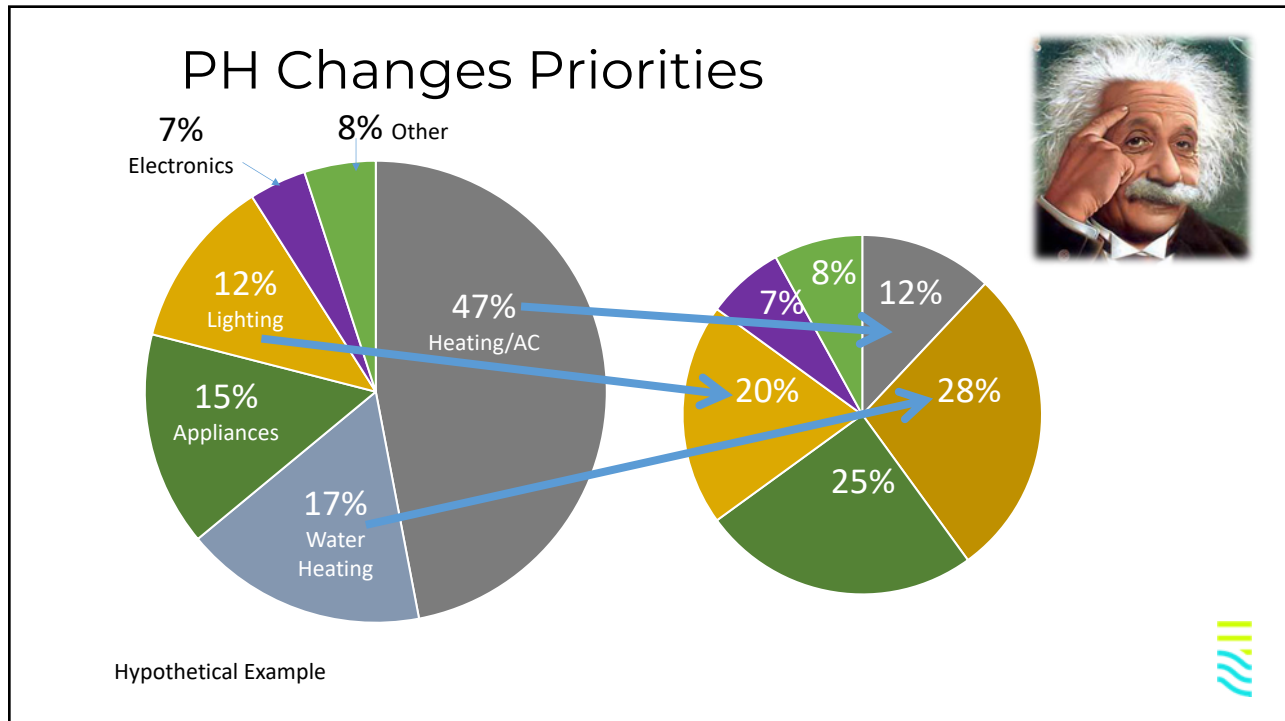
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Passive House Performance

- 80% to 90% reduction in energy for heating/cooling
- Up to 70% reduction in energy for water heating
- Up to 95% reduction in energy for lighting
- Reduction of airborne pollutants and CO2 emissions
- Comfort, Health and Resilience
- Enhances, and reduces the impact of, renewable energy

40 Watts 450 Lumens

6 Watts 450 Lumens

Same Light with 87% Less Energy

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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)

PH
CA

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Passive House is Scalable

PH
CA

66

66



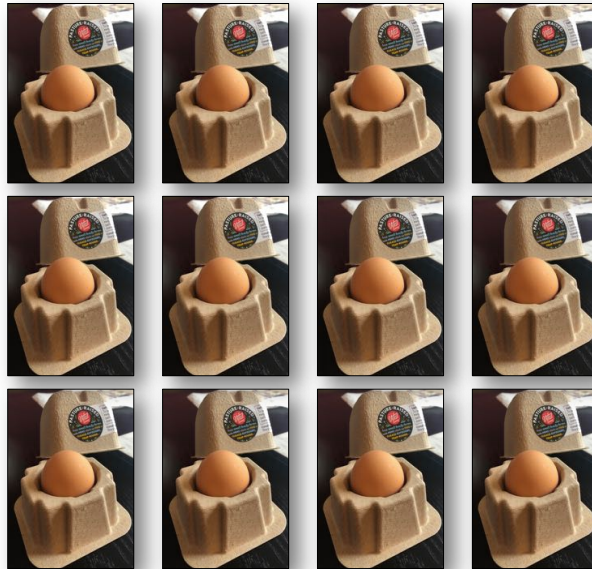
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Safe and
Comfortable
for a Single
Family



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Safe and Comfortable for Multifamily



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Safe and Comfortable is Cheaper by the Dozen



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The Logic in Circles: Need for Housing in CA

Adding 80,000 ± Living Units a Year

We Need 180,000 Living Units Every year 2020-2025

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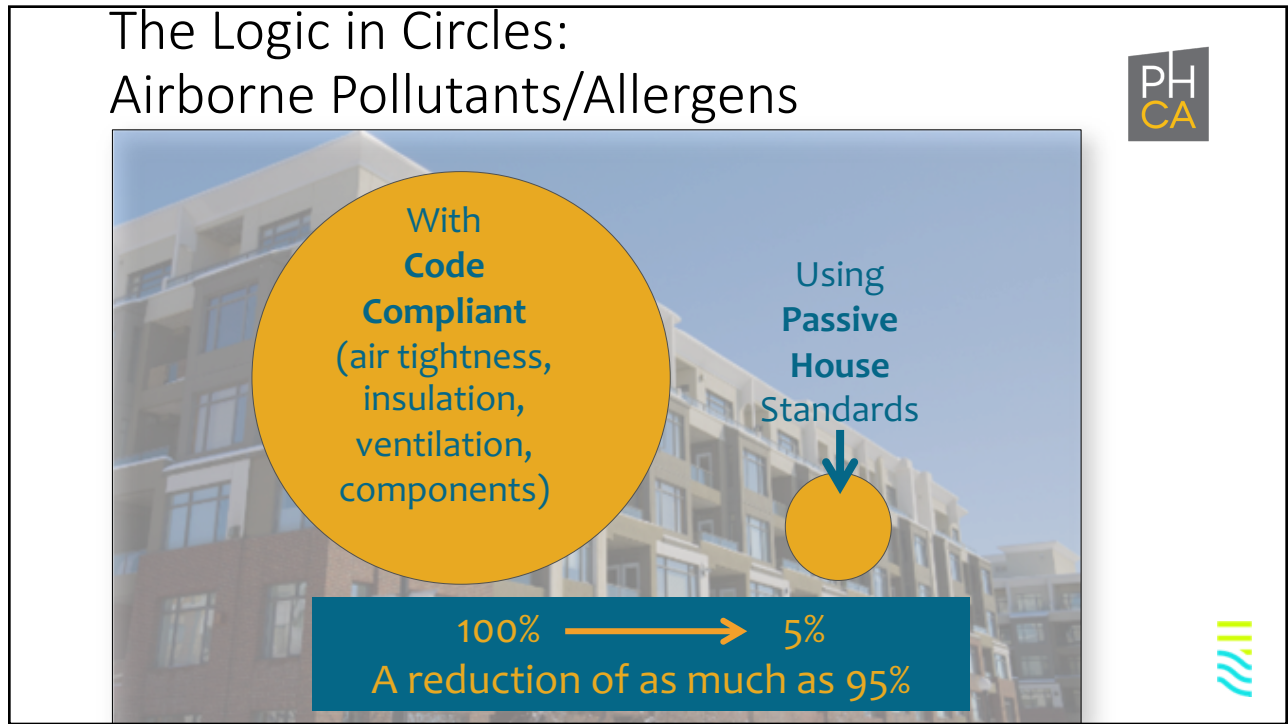
The Logic in Circles: Operational Energy Required

Code Compliant (air tightness, insulation, ventilation, components)

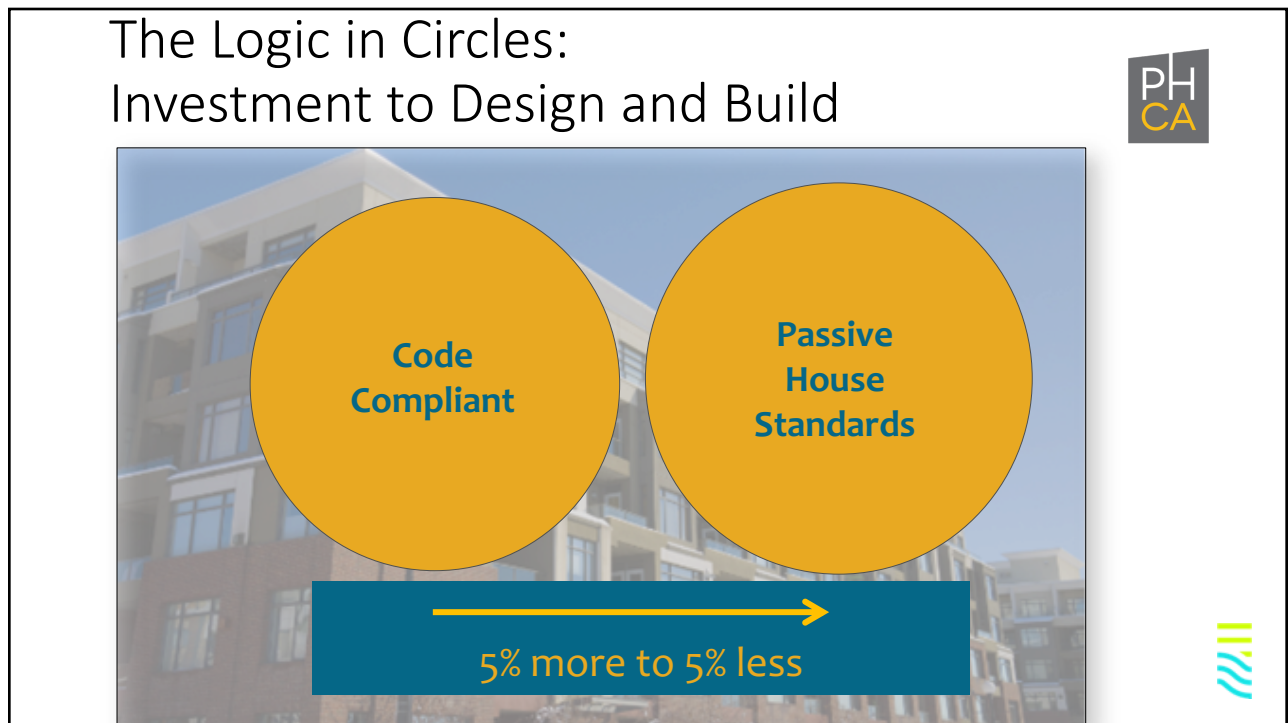
Passive House Standards

100% → 30%
A reduction of as much as 70%

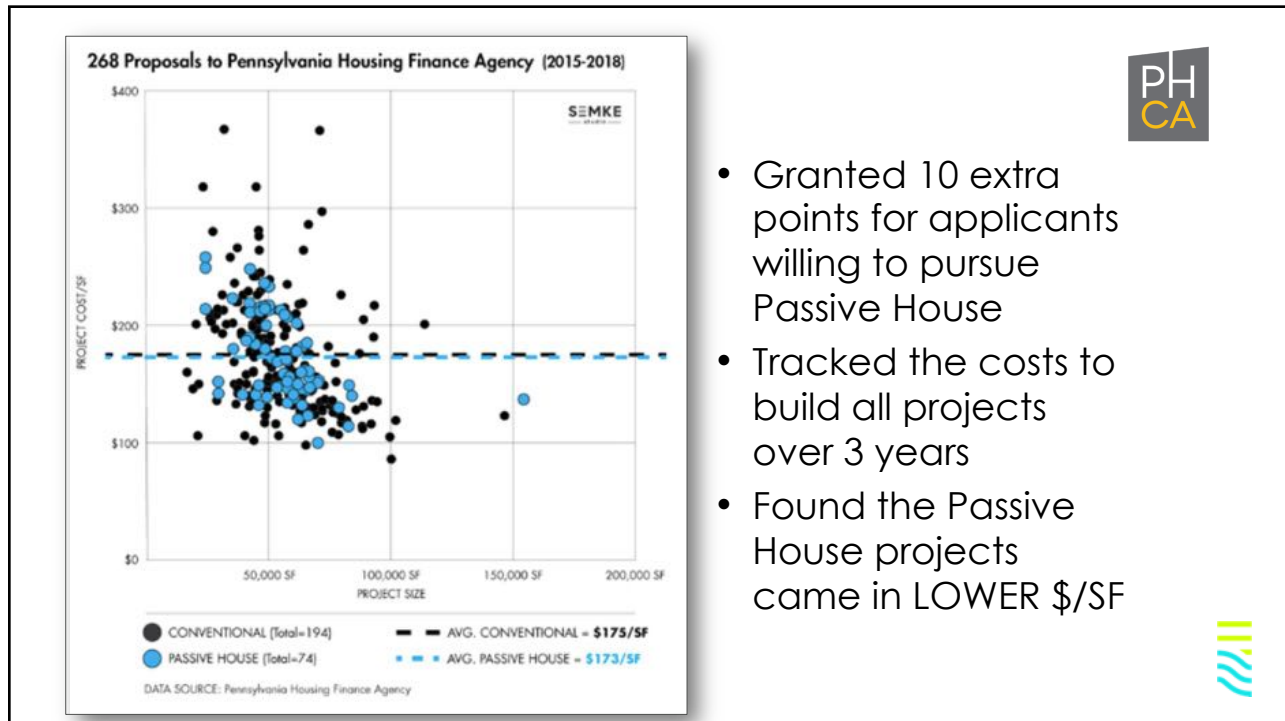
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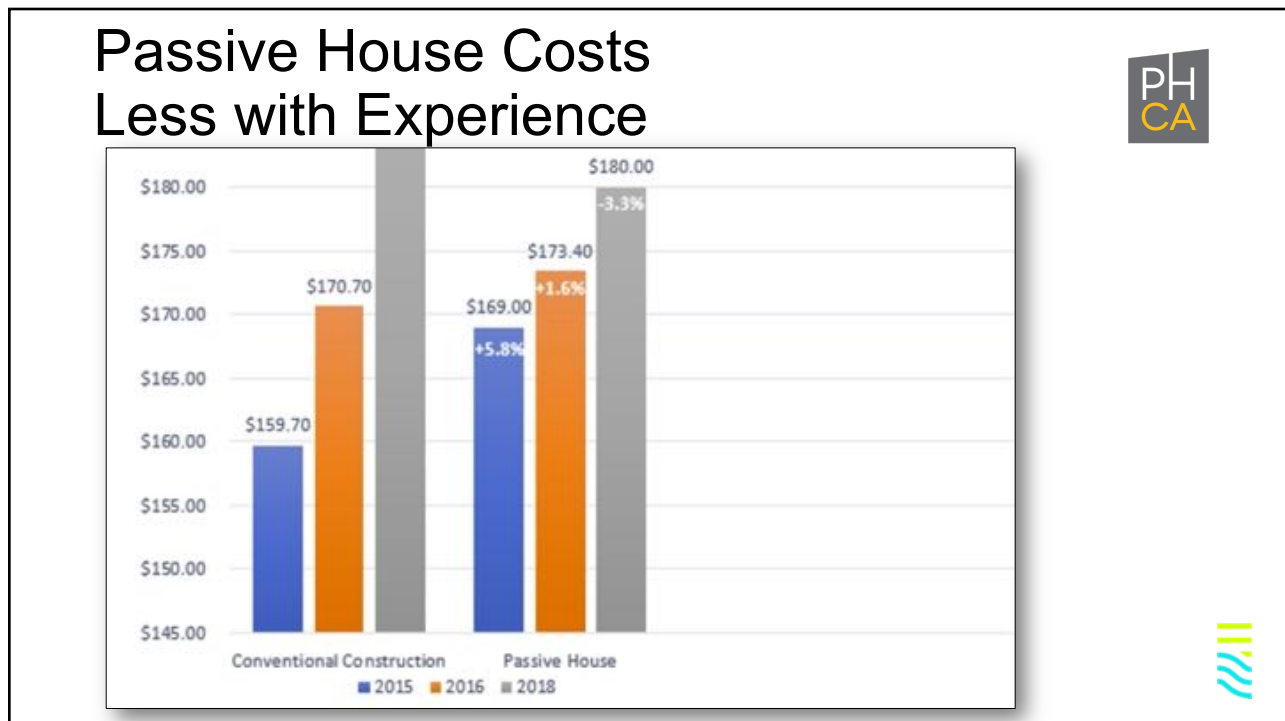
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The Logic in Circles: For the People – For the Planet



The Question is not Why? It is WHY NOT?



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Evidence Based Performance



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Evolution of Sustainability



From 1960 – 2020

- Conservatism and Activism - **Think It**
 - EDF, Greenpeace
- Prescriptive Standards - **Choose It**
 - Energy Star, LEED, BIG
- Performance Standards - **Measure It**
 - Passive House, RESET AIR, WELL Building
- Performance Accountability - **Prove It**
 - Legislation, Disclosure Ordinances, Stretch Codes



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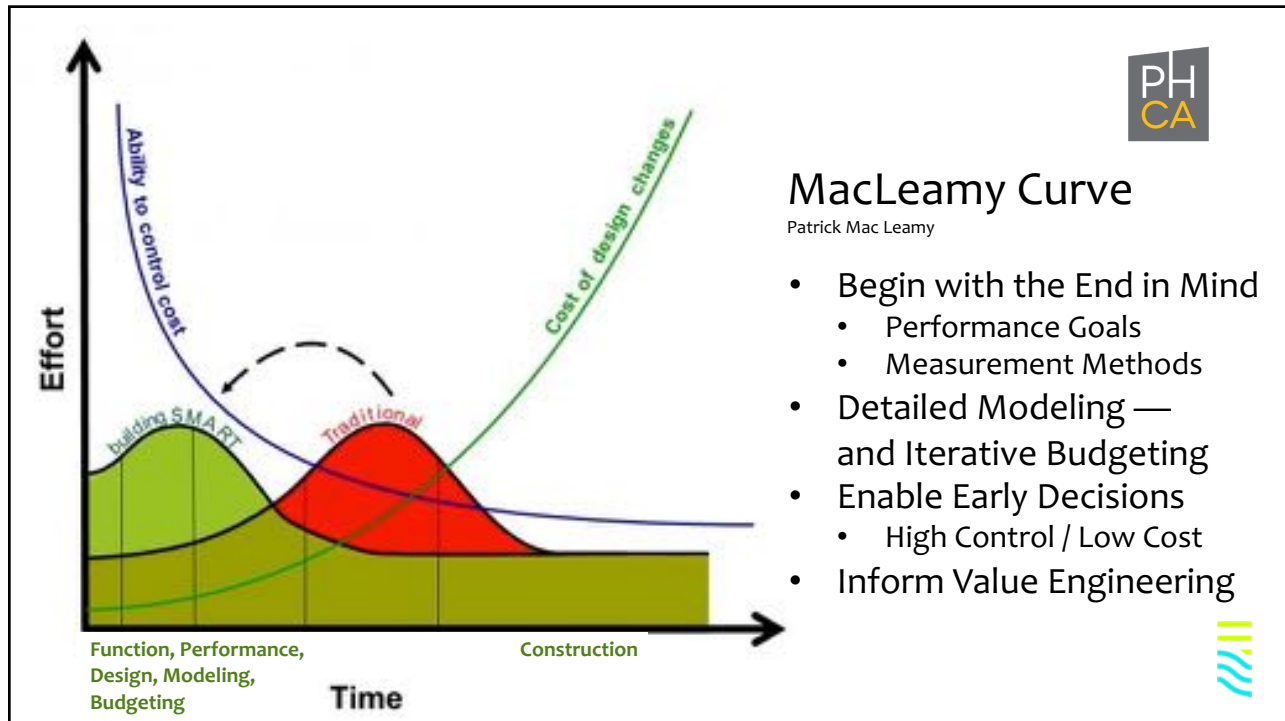
“Evidence Based Performance”



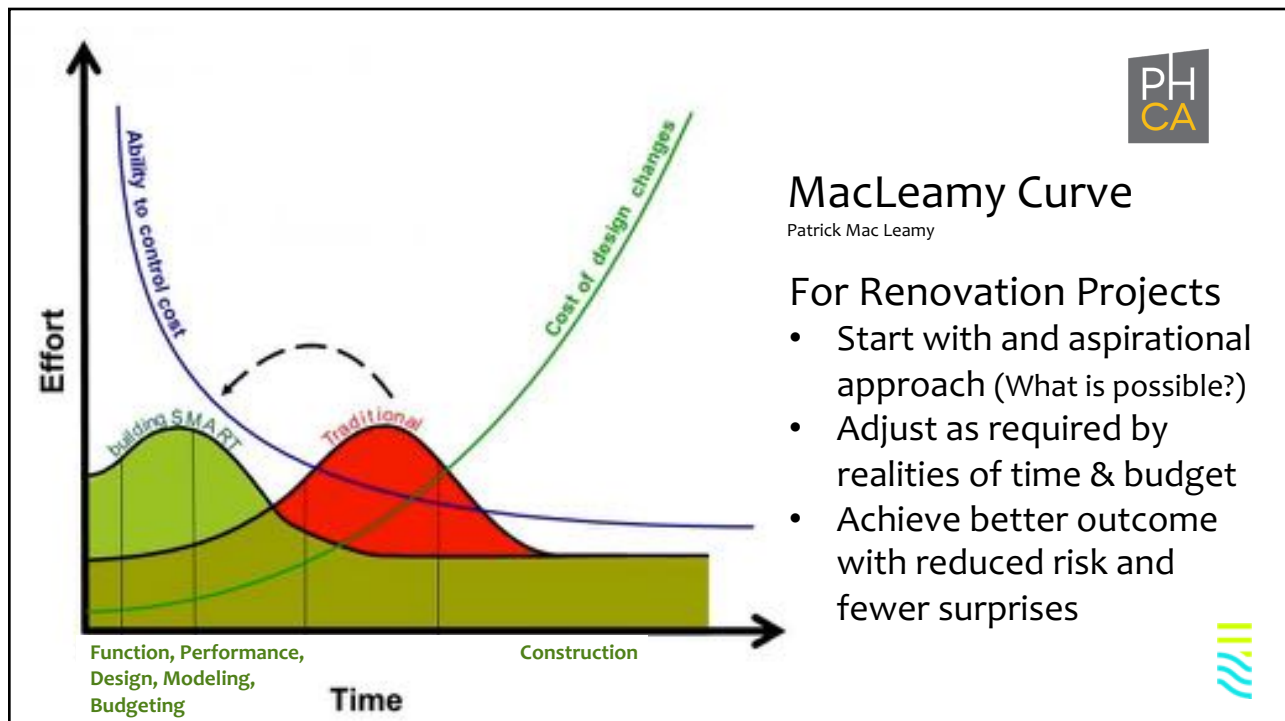
- Set Performance Goals & Measurement Methods
- Employ Detailed Modeling
- Testing/Commissioning to Verify Performance
- Monitor Performance and Occupant Experience



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Owner's Project Requirements (OPR)

- Envelope (Airtightness, Insulation Values, Thermal Bridge Analysis)
- Energy Efficiency (Site EUI, Renewables)
- Indoor Air Quality (Continuous Fresh Air Ventilation Rate, Temperature, Humidity, CO2, CO Particulates, Ventilation rate)
- Water Management (Potable Water Reduction and Quality, Storm Water Reduction)
- Indoor Environmental Quality (Sound, Light)
- Materials (Toxicity, Embodied Energy)
- Community (Social Equity and Inclusion, Community Benefits)
- Operations and Maintenance (Annual Budgets)
- Waste Management (Construction and Post Construction Waste)



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Incorporate Performance Criteria



Bias to Tested, Modeled, Measured, and Monitored



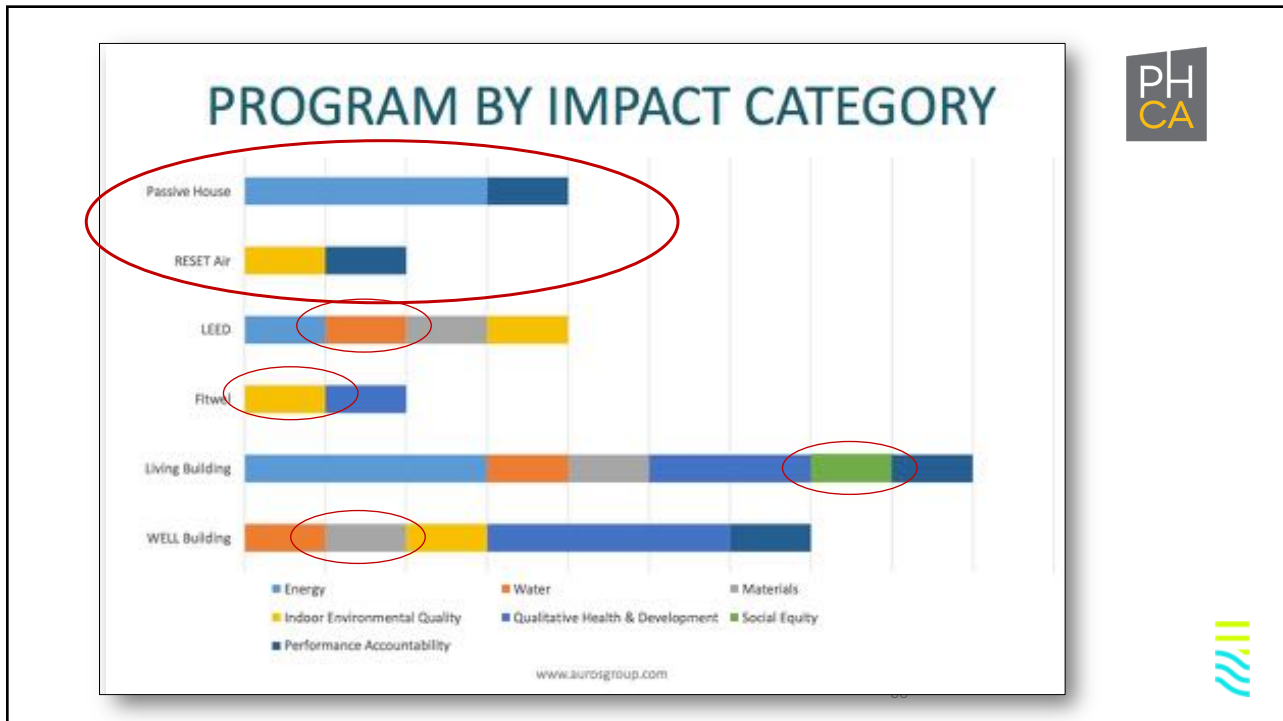
84

<h1>Owner's Project Requirements</h1>	<h2>Define Success in Operations</h2>	Targets & Goals		
		<p>SUSTAINABILITY PROGRAM GOALS</p>		<p>Passive House (PHI) Classic Standard (certification) RESET Air (certification) Fitwel (certification)</p>
				<p>C-PACE (compliance) p4 Performance Measures (narrative only) The 2030 Challenge (compliance)</p>
		<p>MEASUREMENT AND VERIFICATION</p>		<p>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 Converged Network, Open-Integration Data Platform and DDC System Optimal Solar Integration</p>
		<p>COMMUNITY</p>		
		<p>MWDBE Subcontracting Participation</p>		25% to MBEs and 10% to WBEs
		<p>MWDBE Tradesperson Participation</p>		25% to Minority and 10% to Women
		<p>Qualitative Health and Development</p>		
		<p>Workforce Training and Education</p>		Passive House Tradesperson and Renewables Technologies
		<p>ENERGY</p>		
		<p>Site EUI</p>		14-20 kBtu/sf/yr
		<p>Renewables (Photovoltaic Panels)</p>		TBD
		<p>INDOOR AIR QUALITY</p>		
		<p>Carbon Dioxide (CO2)</p>		< 600 ppm
		<p>Humidity</p>		Monitored
<p>Ozone (O3)</p>		< 51 ppb		
<p>Particulate Matter 2.5 (PM2.5)</p>		< 12 µg/m3		
<p>Radon</p>		< 0.148 Bq/L [4 pCi/L] in the lowest occupied level		
<p>Temperature</p>		Monitored		
<p>Total Volatile Organic Compound (TVOC)</p>		< 0.4 mg/m3 (< 400 µg/m3)		

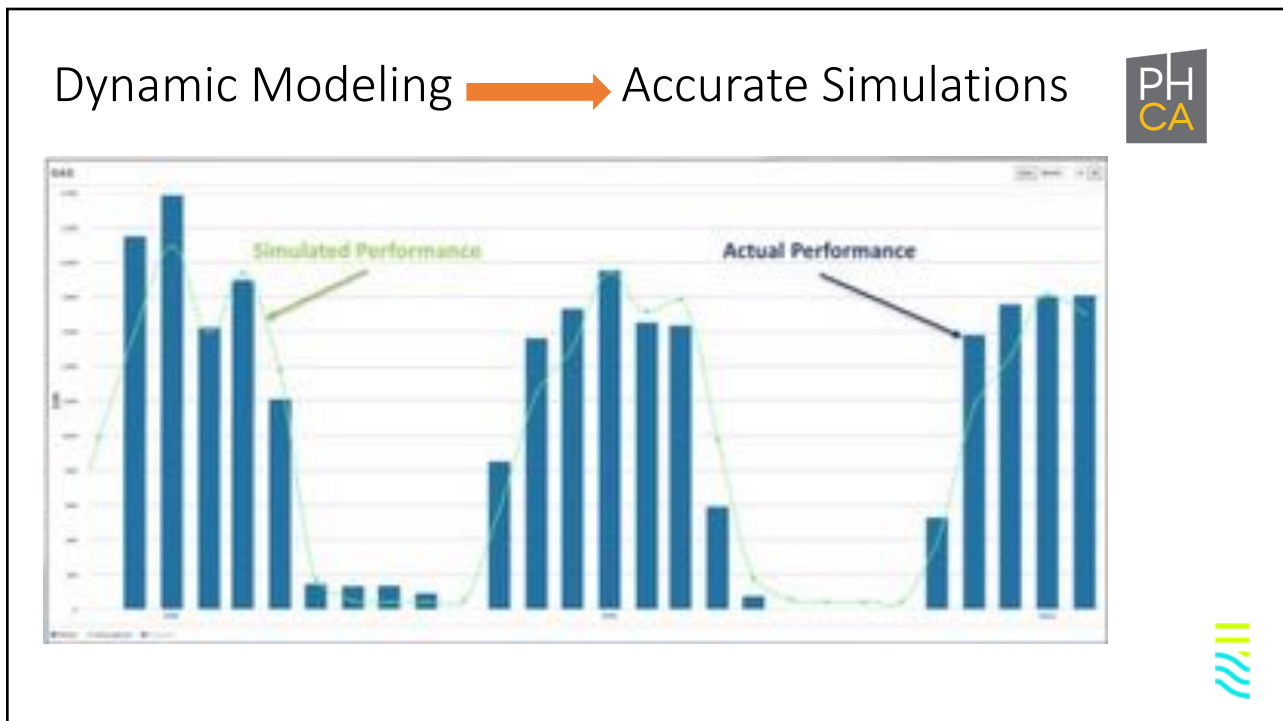
86

<h1>Owner's Project Requirements</h1>	<h2>Define Success in Operations</h2>	Targets & Goals		
		<p>INDOOR ENVIRONMENTAL QUALITY</p>		<p>WELL compliance with S01 Sound Mapping WELL compliance with S02 Maximum Noise Level</p>
		<p>LANDSCAPING</p>		
		<p>Beauty</p>		Exterior Wall Mural, Local Artist
		<p>Biophilia</p>		Use Natural Materials Activate Public Plaza
		<p>MATERIALS</p>		
		<p>Material Toxicity</p>		<p>WELL compliance with XD9 Cleaning Products and Protocol WELL compliance with X10 Volatile Compound Reduction WELL compliance with X11 Long-Term Emission Control WELL compliance with X12 Short-Term Emission Control LEED compliance with MR Building Product Disclosure and Optimization - Material Ingredients</p>
		<p>OPERATIONS AND MAINTENANCE</p>		
		<p>Annual Maintenance Budget</p>		Annual expense analysis
		<p>WASTE</p>		
		<p>Construction Waste</p>		LEED compliance with MR Construction and Demolition Waste Management Planning
		<p>Post-Construction Waste</p>		WELL compliance with XD4 Waste Management
		<p>WATER</p>		
		<p>Potable Water Reduction</p>		50% total water reduction from Pittsburgh 2030 District Goals, with efficient fixtures
		<p>Potable Water Quality</p>		<p>WELL compliance with W01 Fundamental Water Quality WELL compliance with W02 Water Contaminants WELL compliance with W03 Legionella Control WELL compliance with W04 Enhanced Water Quality WELL compliance with W05 Water Quality Consistency WELL compliance with W08 Handwashing WELL compliance with W09 Onsite Non-Potable Water Reuse Implement grey water solution for toilets and landscape irrigation</p>
<p>Storm Water Reduction</p>				
<p>TRANSPORTATION</p>				
<p>Bicycle & Scoobi Share, Bicycle Parking Bicycle Storage and Support BRT Access Point</p>		LEED compliance		

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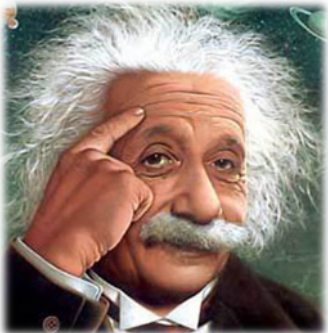




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Efficiency is the First “Renewable”

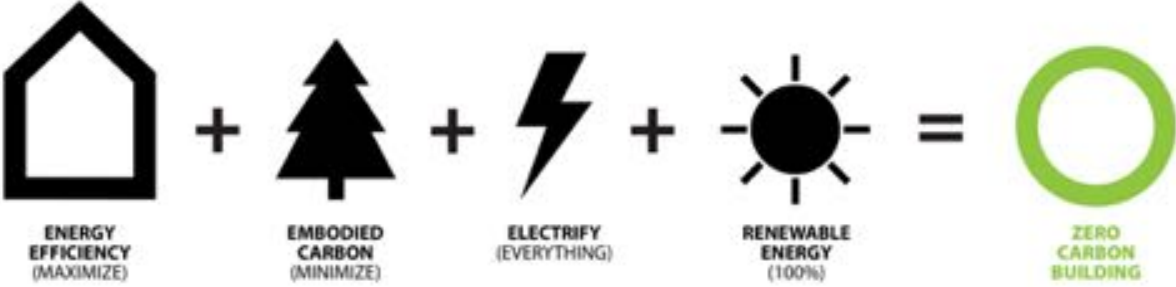
“The cheapest energy is the energy that you don’t use”

- Once designed in, it delivers performance continually (Passive)
- The natural order of decarbonization
 - Maximize Efficiency (PH)
 - Minimize Embodied Carbon
 - Electrify Everything
 - Add Renewables







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The Natural Order of Decarbonization



ENERGY EFFICIENCY (MAXIMIZE) + EMBODIED CARBON (MINIMIZE) + ELECTRIFY (EVERYTHING) + RENEWABLE ENERGY (100%) = ZERO CARBON BUILDING

Creative Commons (credit + link to passivehouseaccelerator.com)

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Building Blocks to Achieve High Performance



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Using the Steps for an RFP



REQUEST FOR PROPOSALS

Affordable Housing Development Opportunity

On Four City-Owned Properties

The Harbor Yard – 417 Figueroa Street

Parking Lot 14 – 442 Adams Street

Calle Principal Parking Garage – 438 Calle Principal

Madison Street between Dutra and Van Buren

<https://monterey.org/Services/Community-Development/Housing>



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Addendum for Efficiency and Health

- **INTRODUCTION added:**

“They shall have a commitment to producing safe, affordable, durable, beautiful, healthy and energy efficient housing.”



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Addendum for Efficiency and Health

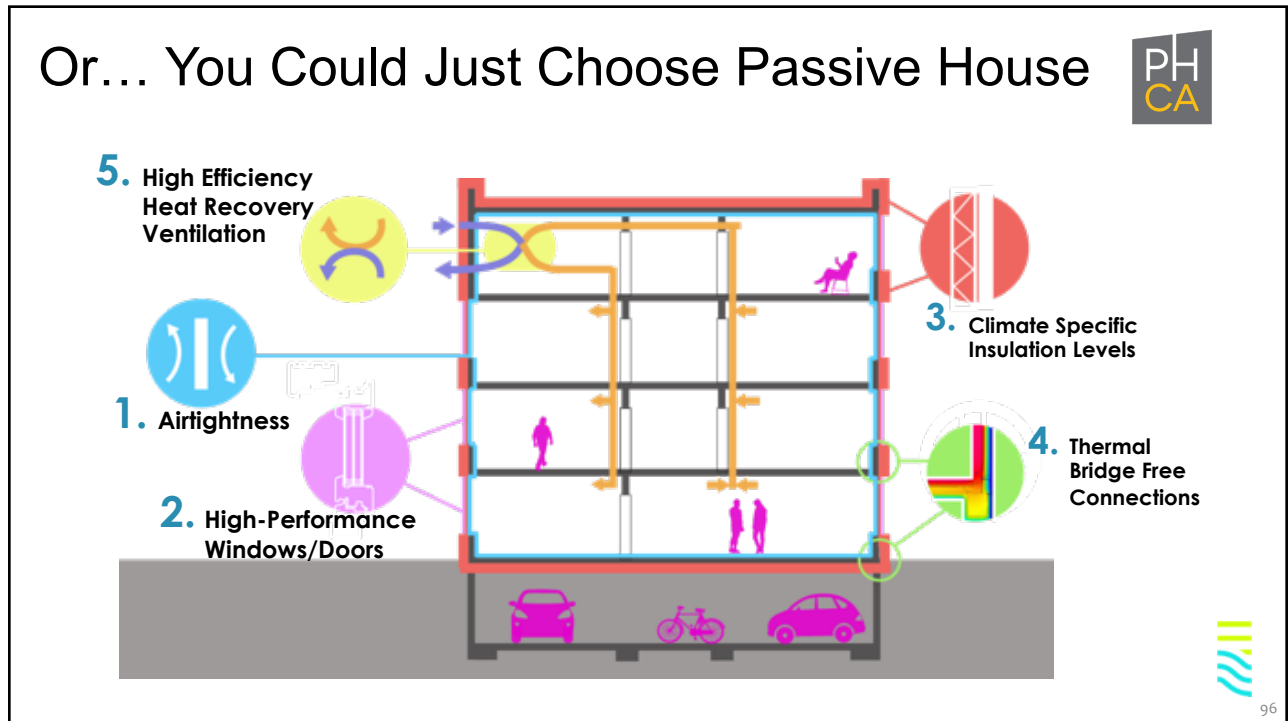
- **Evaluation Criteria: (up from 155 to 175)**

“Project Energy Efficiency and Healthy Indoor Air Quality (20 points maximum)

- *Net Zero energy demand (3 points max)*
- *All electric usage (3 points max)*
- *Air-tightness of building envelope (3 points max)*
- *Continuous fresh air in a balanced system with heat recovery (5 points max)*
- *Thermal bridge analysis (2 points max)*
- *Energy storage (2 points max)*
- *Other strategies to reduce embodied and operational carbon (2 points max)”*



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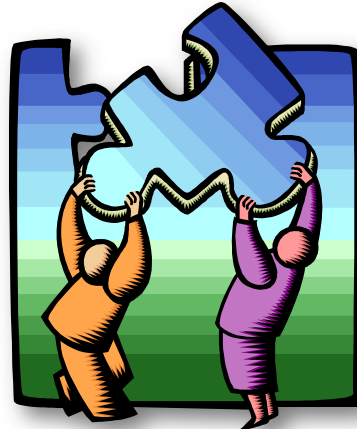


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Stay Informed – Get Involved



- My opinion
 - Response to climate change will dominate the the next several decades
 - This will create expanding opportunities in related industries and within all companies
- Look for opportunities where you can make a living... and a difference

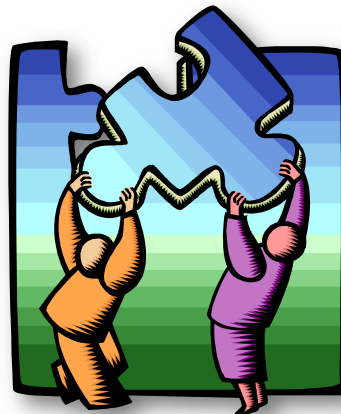


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Steps to Success



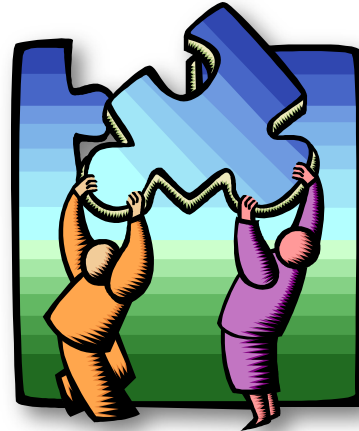
- Identify the Leaders
- Set Higher Targets
- Support Front Runners
- **Educate Everyone**
- Remove Barriers and Increase Incentives
- **Pilot Projects**



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Educate Everyone

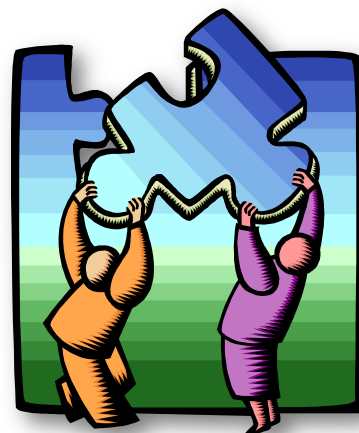
- Do you know of any organizations or groups that might benefit from learning more about Passive House?



100

Potential Pilot Projects

- Are you aware of, or do you have any ideas for Pilot Projects in planning or on the horizon?



101

Proof of Concept

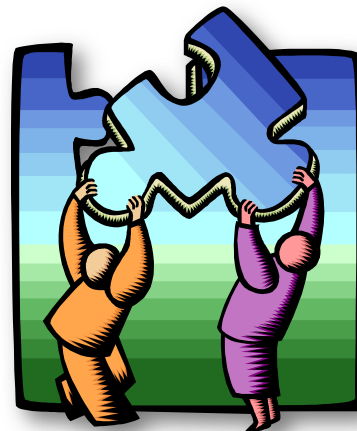


102

Add Your Voice in Support



- In the future there will be opportunities to support programs and/or policies that will move toward “doing better”
- Would you like to add your voice to the conversation?

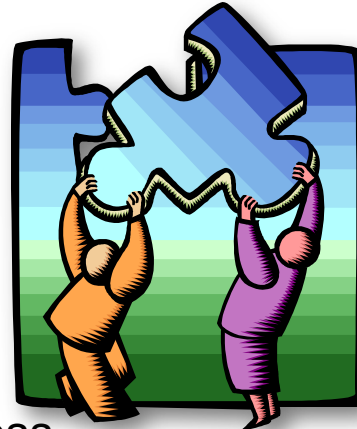


103

Personal Opportunities



- Are you getting ready to build or remodel a new home, multifamily, or commercial building... or do you know someone who is?
- Electrification – Heat Pumps for Heating/AC, and Hot Water
- Renewables for Home or Business



104

Personal Opportunities NAPHNetwork.org



- Passive House Training & Education



105

Support Passive House CA



- 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@concomt.com
(831) 320-8538

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

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Communicating the Value of High Performance



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AHA! — Useful Phrases



- Quality is more than the absence of defects — It is the presence of value
 - Code is the minimum acceptable standard (pass/fail)
 - It is about eliminating known defects (example: 24x7 bathroom fan)
- Performance is an element of Quality
 - Owners choose perceived quality (appliances, cabinets, countertops, fabrics, finishes, etc.)
 - Yet allow construction based the minimum legal requirements
- Skate where the puck is going to be (reach codes, step codes)
 - Seat belts, air bags, anti lock brakes, roll bars, collapsing frames, reinforced doors — all were innovations and were extra cost options — but they became standard because they made sense
- Future Proof your home/building (code cycles – step codes)



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Prescriptive Versus Performance

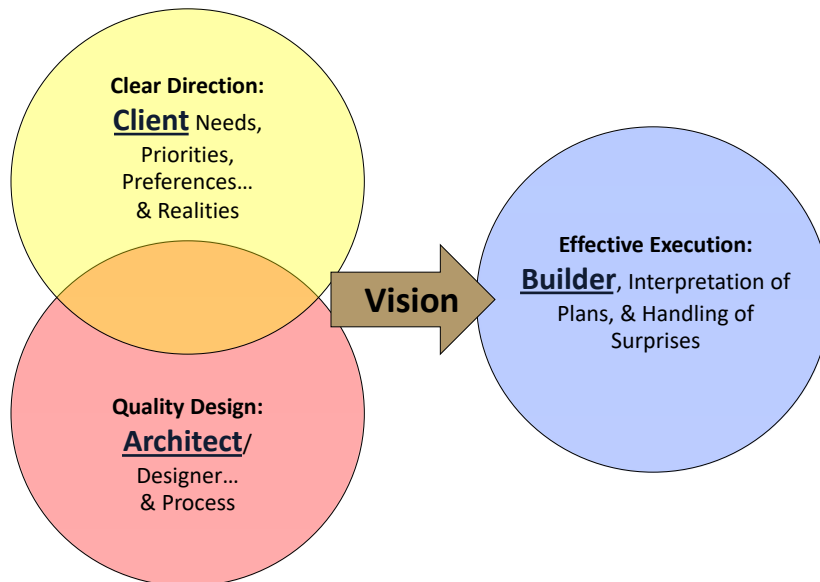


- Function is a yes/no decision — Performance needs to be modeled and/or measured
- A building is a system, and all elements need to work together to achieve desired performance
 - Individual football players are important, but they play positions as a team and work together based on a game plan

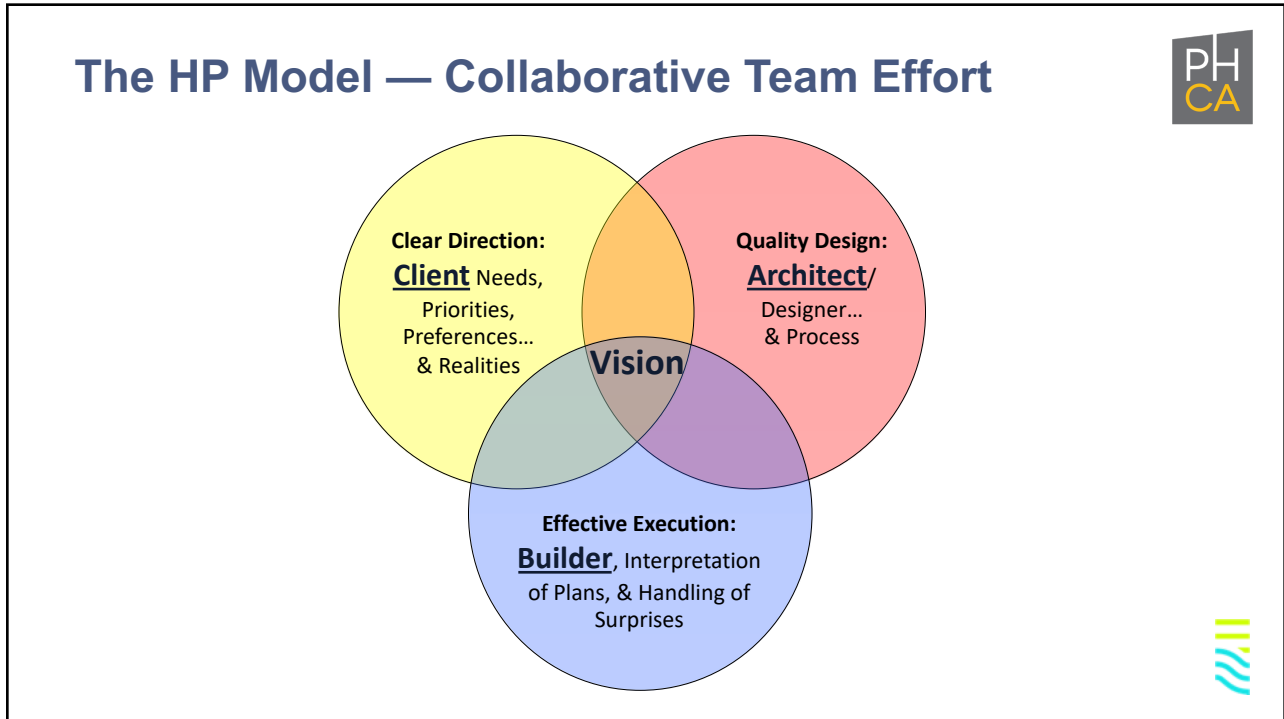


110

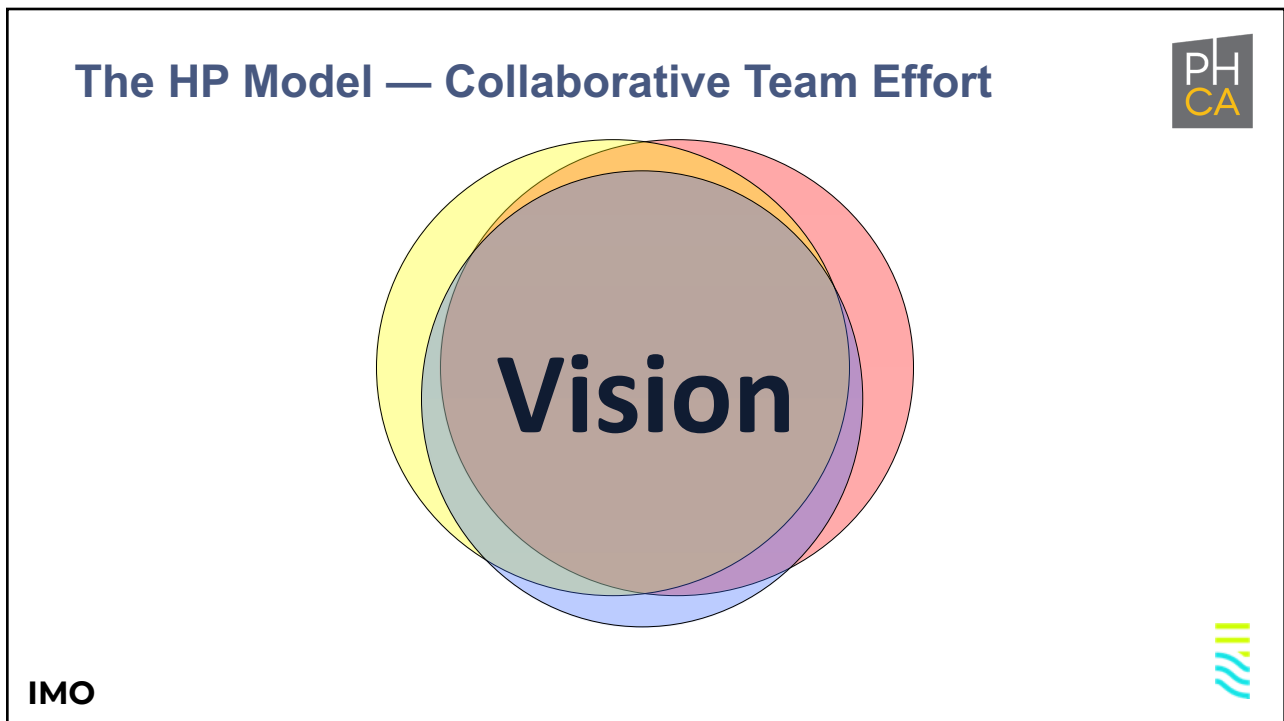
The Old Model — A Relay Race



111



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113



Intelligence Behind the Choices



- A contractor can bring knowledge, experience, & possibilities related to Cost, Function, and Performance
 - Registers under windows
 - Advanced framing
 - Build up or excavate
 - Porous countertops... waxed flooring
 - Reduction of thermal bridges
 - Airtightness and spiders and other insects



114



Take an Aspirational Approach



- Begin with High-Performance as the Baseline
 - Typically begin with function and Code as the baseline
 - That makes High-Performance upgrades optional
- When you take the “what is possible” approach
 - You can then look for ways to reduce investment in multiple places (Granite/marble, Wolf, Sub-Zero, Radiant, etc. — and Performance)
- You enable better decisions and higher performance
 - The choices are system related and achieves better results
- Plus – People love to win, but REALLY HATE to lose or miss an opportunity



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Quantifying the Value of High Performance



- When you select running shoes
 - Price range is a major factor
 - Features are important (waterproof, arch support, warranty, etc.)
 - Meeting your performance needs is key (fit/comfort, and fit with your intended use)
 - 5% or 10% more or less \$ is irrelevant to your choice among options
 - The features and performance “for you” enable you to choose based on value rather than first cost



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Open Plan Office Systems


“We preferred buying from you, but...”



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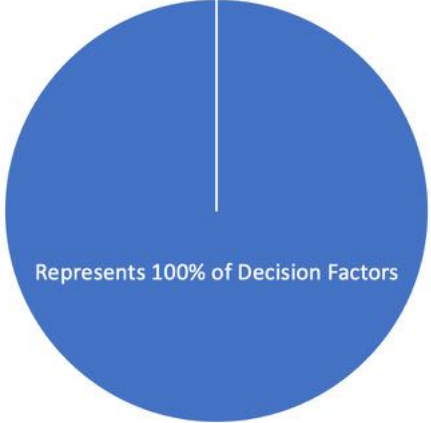


Quantifying the Value of High Performance




Assume or Imagine:
 You are choosing between two completed homes/buildings that are identical in appearance and function, but there are differences that you cannot see — that relate to performance

Step 1:
 Determine what percentage of your decision between alternatives will be based on cost




Represents 100% of Decision Factors


Converts to 100
 “Value Points” available



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Quantifying the Value of High Performance



In this Example:
 You decide that cost is very important, and that 80% of your decision will be based on first cost


Step 2:
 Determine what factors will make up the remaining 20% of your decision



20% of Decision based on other factors

80% of Decision based on First Cost

80 Value Points for First Cost,
 20 Value Points remaining



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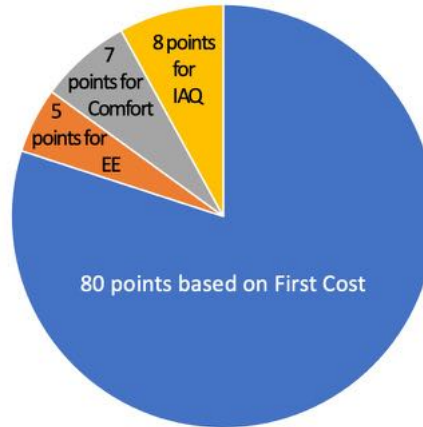


Quantifying the Value of High Performance



In this Example:
 Since the differences relate to “Performance” you choose Energy Efficiency, Comfort, Indoor Air Quality as the factors

Step 2:
 Assign the 20 remaining value points as 5 points for Energy Efficiency, 7 for Comfort, and 8 for Indoor Air Quality



Remaining 20 Value Points assigned to Performance Factors



120

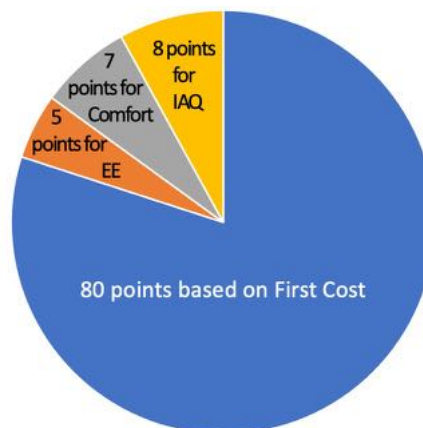


Quantifying the Value of High Performance



Reality:
 The budget tell us that the first cost of the high-performance home will be 7% more


Step 3:
 Assign Value Points related to first cost




Remaining 20 Value Points assigned to Performance Factors



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Quantifying the Value of High Performance




- Performance of the Passive House is best in all categories so receives full value points
 - Efficiency – 5 Value Points
 - Comfort – 7 Value Points
 - IAQ (Health) – 8 Value Points} 20 Value Points


- Performance of the Passive Code House
 - Half as Efficient – 2.5 Value Points
 - Less Comfortable – 5 Value Points
 - Dramatically poorer IAQ – 2 Value Points} 9.5 Value Points

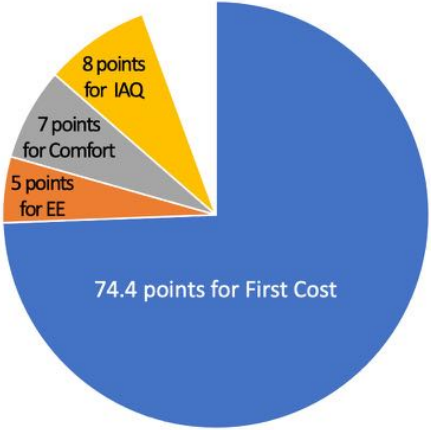


122

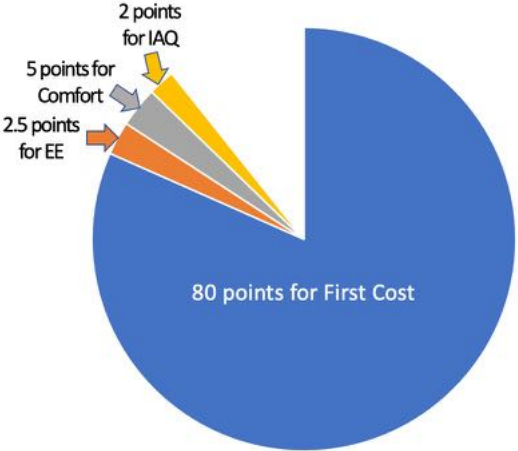


Quantifying the Value of High Performance






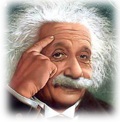
Passive House = 94.4 Points



Code House = 89.5 Points



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Remember



- It is about the People,
Not the Project
- Desire to get something is less
important than the fear of missing out
- Need – Trust – Hurry:
In that order



124

Cachagua Passive House Project



125

Near the top of Cachagua Road



126

Guardrail Settled after Posts Burned



127

Sky Ranch Road just east of the PH



128

Sky Ranch Rd. across from previous



129

Cachagua Passive House



130

Looking Left (SE) as Walking In



131

Looking West



132

Looking South from the Deck



133

Looking Down (E) from the Deck



134

Looking Southeast from the Deck



135

Cachagua Passive House



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