We will be starting soon!

Thanks for joining us
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
3C-REN
Staff Online
Thank you for the Opportunity

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

Jay Gentry
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.
“... for dummies ‘laypersons’ means something that has been laid out for laypersons in simple terms... with the intent that anyone can follow them easily even without an in-depth knowledge on the subject.”
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
Intelligent and Purposeful Choices

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

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

“Passive Design”— Maximize benefits and minimize energy requirements by taking advantage of nature and building science
Intelligent and Purposeful Approach

Passive Design protocols to achieve comfortable, healthy, and extremely efficient buildings — with no aesthetic compromise
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 and shift the source of that energy to renewables
- Passive House protocols are part of the solution
Passive House
Passive House Multifamily
Passive House City Block

750,000 sq. ft. Mixed Use, with 655 Affordable Units, plus Commercial Space and a School
Today’s Presentation (1/2)

- Passive House and how it fits with other sustainability initiatives in our efforts to mitigate the Climate Crisis
- In our 90 minutes, we will explore:
  - The building blocks of Passive House
  - How PH protocols deliver high performance
  - Impacts of PH on occupants, communities, and the future of the planet
  - Evidence Based Performance
- A critical part of the solution to climate crisis, housing crisis, ongoing health of people and the planet
Today’s objective: Put you in position to make informed decisions on whether and how you make a difference for PH

- 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

Deputy Secretary-General Amina J. Mohammad described Passive House as a model for the developing world and the developed world.


Passive House has Arrived
Exponential Growth of Passive House buildings in Pipeline in North America

- 200K SF (~200,000 SF) in 2009
- >10M SF (>10 million SF) in 2020
- >15M SF (>15 million SF) by 2020
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
Passive House Delivers Performance

“This is not just a scientific experiment. This is the solution…”

Amory Lovins – Rocky Mountain Institute, 1995
Passive House Classic

Passive House Plus

Passive House Premium

Energy Design Rating (EDR), defined by the California Energy Commission, is an alternate way to express the energy performance of a building using a scoring system where 100 represents the energy performance of the Residential Energy Services (RESNET) reference home characterization of the 2006 IECC with California modeling assumptions. A score of 0 represents the energy performance of a building that combines high levels of energy efficiency with renewable generation to “zero out” its TDV energy.
Understanding Passive House

Yearly primary energy use for space heating per treated floor area

![Graph showing yearly primary energy use for space heating per treated floor area across different countries.](image)
Passive House is “Passive”
Summer Solstice 3:00 PM
Winter Solstice 3:00 PM
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
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
The wing on a race car
Reverse angle diagonal parking
Another Elegant Solution
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”
Passive House Efficiency

Enables this approach to Net Zero
Renewables without Addressing Efficiency First

May require this approach to reach Net Zero
Goal: Drive from Ventura to San Francisco

- Zero stops for fuel
- Even though driving a car with a bad transmission and leaky fuel line
Goal: Drive to Los Angeles

All you need is a bigger gas tank
How Passive House Delivers Performance
Summer Solstice 3:00 PM
Winter Solstice 3:00 PM
• 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
Passive House – The Basics

• Many elements but the big 3 are
  – Airtight building shell
  – Better insulation correctly applied
  – Mechanical ventilation with heat recovery
Many elements but the he big 3 are
- Airtight building shell
- Better insulation correctly applied
- Mechanical ventilation with heat recovery
Insulated Thermos vs. Heated Pot
Passive House – The Basics

- Many elements but the he big 3 are
  - Airtight building shell
  - Better insulation correctly applied
  - Mechanical ventilation with heat recovery
Five Key Principles:

1. Airtightness
2. High-Performance Windows/Doors
3. Climate Specific Insulation Levels
4. Thermal Bridge Free Connections
5. High Efficiency Heat Recovery Ventilation
High Performance Windows

- Airtight
- Double or Triple Pane
- Argon and Low E
- Thermal Tactics
Passive House – The Basics

- Many elements but the he big 3 are
  - Airtight building shell
  - Better insulation correctly applied
  - Mechanical ventilation with heat recovery
Eliminate Thermal Bridges
Five Key Principles:

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Heat/Energy Recovery Ventilation

Outdoor air intake: fresh air into unit

Extract air: stale air from baths/kitchens/laundry

Exhaust: post-recovery air to outside

Supply air: fresh air into living rooms, offices, classrooms
Heat/Energy Recovery Ventilation

90% Efficient

30°F → 34°F

70°F ← 66°F
How Does That Work?

Inside

Warm Air Flowing Out

Cool Air Flowing In

Outside

Outside

30° 39° 48° 57° 66°

34° 43° 52° 61° 70°
90% Versus 80% Efficiency

Seems like a pretty small difference

But it doubles the energy required to generate the heat and distribute the warmer air
PH Changes Priorities

The Passive House Impact: Source Energy Use Intensity (pEUI) Distribution Comparison

- 130 kBtu/ft²/yr
- 50 kBtu/ft²/yr

14% PUMP & AUX ELEC
10% LIGHTING
15% PLUG LOADS
15% DHW DEMAND
8% COOLING
38% HEATING
13% LIGHTING
13% PUMP & AUX ELEC
5% HEATING
6% COOLING
34% PLUG LOADS
29% DHW DEMAND

Typical NYC Multifamily Residential Building

Multifamily Passive House Building

Passive House Performance

- 80% to 90% reduction in energy for heating/cooling
- Up to 70% reduction in total energy use
- Up to 95% reduction in unwanted infiltration of airborne pollutants and allergens
- Comfort, Healthy Indoor Air, Durability, and Resilience
- Enhances, accelerates, or magnifies the impact of renewables
Passive House is Scalable

From a Backyard ADU To a Single Family Residence
Safe and Comfortable for a Single Family
Safe and Comfortable for Multifamily
Safe and Comfortable is Cheaper by the Dozen
The Logic in Circles:
Need for Housing in CA

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

Adding 80,000 + Living Units a Year
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%
The Logic in Circles: Airborne Pollutants/Allergens

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

Using Passive House Standards

100% → 5%
A reduction of as much as 95%
The Logic in Circles:
Investment to Design and Build

Code Compliant

Passive House Standards

5% more to 5% less
- Granted 10 extra points for applicants willing to pursue Passive House.
- Tracked the costs to build all projects over 3 years.
- Found the Passive House projects came in LOWER $/SF.
Passive House Costs
Less with Experience
The Logic in Circles: For the People – For the Planet

The Question is not Why? It is WHY NOT?
The greatest trend we see today in constructing or renovating sustainable buildings is the movement toward evidence-based performance.

… it’s no longer good enough to design for high-performance or “sustainable” buildings; they are demanding proof of performance in operations.

Beth Eckenrode, The Auros Group Passive House Accelerator April 27, 2020

Evidence Based Performance
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
“Evidence Based Performance”

- Set Performance Goals & Measurement Methods
- Employ Detailed Modeling
- Testing/Commissioning to Verify Performance
- Monitor Performance and Occupant Experience
Essentially, Begin Early — with the End in Mind

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)
Dynamic Modeling ➔ Accurate Simulations
PHPP Roadmap

Start

Building

Verification
Climate Data

Areas (TFA, Exterior Surfaces, TBs)
R-Values
Ground

Windows

Ventilation (Goal n50)

Final protocol worksheet for ventilation systems (external)

Annual Heat Demand (Annual and Monthly Method)

Heating Load (for Passive Houses only)

Cooling Units

Requirements met?

no

yes

Summer

Summer Ventilation

Requirements met?

no

yes

no

yes

DHW+Distribution

Solar-DHW

Electricity

Compact

Aux Electricity

Boiler

DistrictHeat

PE Value

PE Requirements met?

no

yes

Passive House Certificate
• Start with an aspirational approach (What is possible?)
• Adjust down as required
• You will achieve a better outcome
Set Performance Goals and Measurement Methods

Bias to Tested, Modeled, Measured, and Monitored
PROGRAM BY IMPACT CATEGORY

- Passive House
- RESET Air
- LEED
- Fitwel
- Living Building
- WELL Building

Legend:
- Energy
- Water
- Materials
- Indoor Environmental Quality
- Qualitative Health & Development
- Social Equity
- Performance Accountability

www.aurosgroup.com
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
  - Then Electrify Everything
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)
Testing and Commissioning to Verify Performance

- Pressure test to confirm airtightness
- Commissioning to verify installed performance of sub-systems such as:
  - Mechanicals (HVAC) (Including noise level)
  - Electrical (including storage)
  - Controls (design confirmation)
Monitor Performance and Occupant Experience

- Energy Efficiency
- Comfort
- Healthy Indoor Air
- Durability
- Resilience
Evidence Based Performance: Energy Efficiency

- 90% reduction in energy required for Heating and Cooling
- 50% to 70% less energy overall
Evidence Based Performance: Comfort

- Even temperature upstairs and down
- No drafts
- No hot or cold spots
- Comfortable when next to windows
- Quiet
Evidence Based Performance: Healthy Indoor Air

- Balanced ventilation with continuous fresh and filtered air
- 95% reduction in the infiltration of airborne allergens and pollutants
- Humidity within healthy range
Evidence Based Performance: Durability

- Performance of the building envelope
  - Airtightness dramatically reduces unplanned infiltration/exfiltration of air through the structure
  - Carefully specified materials and smart membranes manage water vapor support drying
  - Together they nearly eliminate the risk of condensation and the moisture related damage

- “Right sized” mechanical systems
  - Are generally smaller and extremely reliable
  - Maintain desired temperatures at lower settings and reduced cycling on and off

“The passive house concept turns out to be not only energy-saving but also most notably very durable and extraordinarily low-maintenance.” Springer Link: March 9, 2019
Evidence Based Performance: Resilience

- 50% to 70% reduction in operational energy usage... doubles the impact of available:
  - Renewables
  - Electrical energy storage
  - Thermal energy storage
- Providing twice the Resilience
Evidence Based Performance: Occupant Satisfaction

“Every time I replace the HRV filter, I’m reminded, and thankful, that my family isn’t breathing in what is caught in the filter.” (Palo Alto)

“We love our Passive House.” (Soquel)

“… it’s calming… and we sleep better” (Bay Area)

“… much lower operating cost.” (Berkeley)

“… gives us peace of mind.” (Santa Cruz)

“Once you have experienced a PH home, it is hard to go back to anything else.” (Bay Area)
Building Blocks to Achieve High Performance

- Airtight Building Envelope
- Climate Specific Insulation
- Continuous Fresh Filtered Air
- Balanced Heat Recovery Ventilation
- Renewables
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
Addendum for Efficiency and Health

- **INTRODUCTION** added:
  “They shall have a commitment to producing safe, affordable, durable, beautiful, healthy and energy efficient housing.”
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)”
Or… You Could Just Choose Passive House

1. Airtightness
2. High-Performance Windows/Doors
3. Climate Specific Insulation Levels
4. Thermal Bridge Free Connections
5. High Efficiency Heat Recovery Ventilation
“Do the best that you can until you know better. Then, when you know better, do better.”

Maya Angelou
Steps to Success

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

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

- Are you aware of, or do you have any ideas for Pilot Projects in planning or on the horizon?
Proof of Concept
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?
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
Support Passive House CA

- Join Passive House California
  - Individual Professional Membership
  - Organization/Company Membership
  - Sponsor
  - Donor or Volunteer
Thank You for Your Time and Attention

Jay Gentry
Jay@concomt.com
(831) 320-8538
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
Serves all building professionals

Three services –
  - Energy Code Coach
  - Training and Support
  - Regional Forums

Makes the Energy Code easy to follow

Energy Code Coach: 3c-ren.org/codes
805.220.9991

Event Registration: 3c-ren.org/events
• Serves current and prospective building professionals
• Expert instruction:
  ▪ Technical skills
  ▪ Soft skills
• Helps workers to thrive in an evolving industry

Event Registration: 3c-ren.org/events
Coming soon!

- Free and discounted home upgrades

Stay Tuned: 3c-ren.org/home
Closing

- Continuing Education Units Available
  - Contact ian.logan@ventura.org for AIA HSW LUs
- Coming to Your Inbox Soon!
  - Slides & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
  - QII for Contractors (3/18)
  - Healthy Housing Principles for Real Estate Professionals (3/23)
  - HRV and ERV for Passive House Applications (3/30)
  - Passive House Certification Course for Designers and Consultants (Thurs/Fri in April)
Thank you!

For more info: 3c-ren.org

For questions: info@3c-ren.org
Cachagua Passive House Project
Near the top of Cachagua Road
Patches of Red Fire Retardant
Guardrail Settled after Posts Burned
Sky Ranch Road just east of the PH
Sky Ranch Rd. across from previous
Cachagua Passive House
Looking Left (SE) as Walking In
Looking West
Looking South from the Deck
Looking Down (E) from the Deck
Looking Southeast from the Deck
Cachagua Passive House
Lessons and Observations

- Wildland Urban Interface Code (WUI) makes a difference
- So does All Electric Passive House
  - No Natural Gas or Propane Tanks
  - Airtight with non-combustible Roof and Shell… with wood fiber insulation
  - Continuous fresh, filtered air
• 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