We will be starting soon!

Thanks for joining us

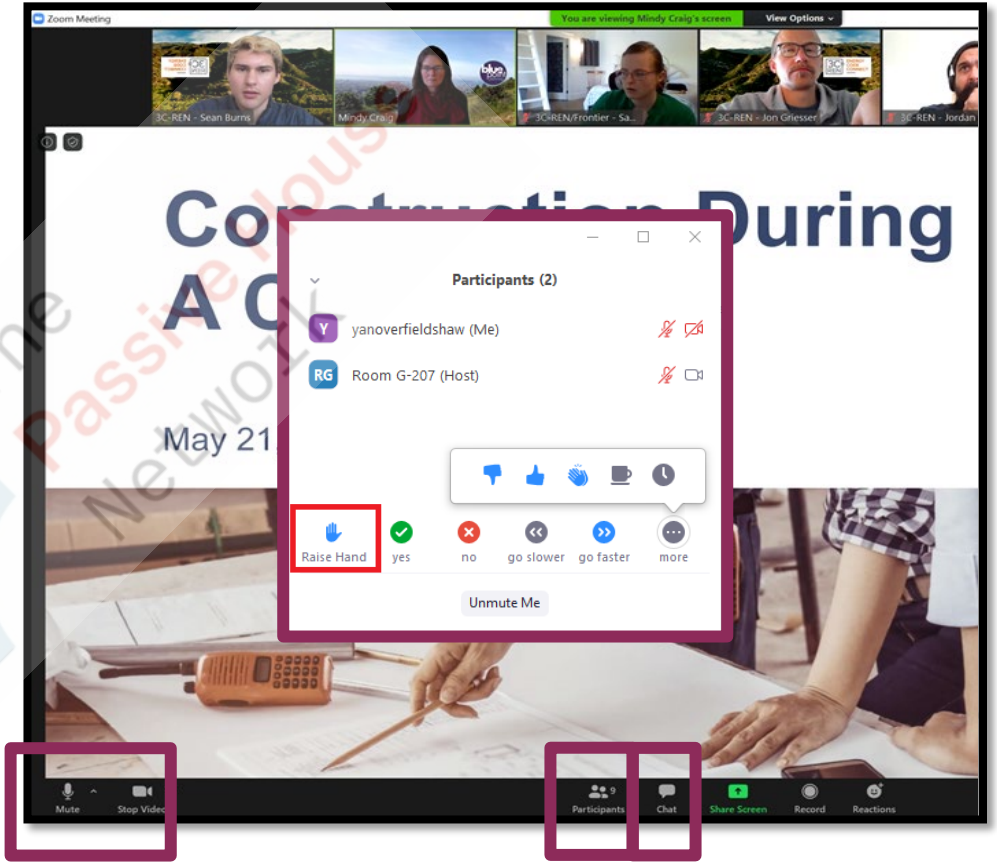
Introduction to Passive House

Steve Mann, The Passive House Network and Home Energy Services

March 7, 2023

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.



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

3C REN ENERGY CODE CONNECT

3C REN BUILDING PERFORMANCE TRAINING

3C REN HOME ENERGY SAVINGS

3C REN ENERGY CODE CONNECT

- 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

3C REN

BUILDING PERFORMANCE TRAINING

- 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

3C REN HOME ENERGY SAVINGS

Multifamily (5+ units)

- No cost technical assistance
- Rebates up to $750/apartment plus additional rebates for specialty measures like heat pumps

Single Family (up to 4 units)

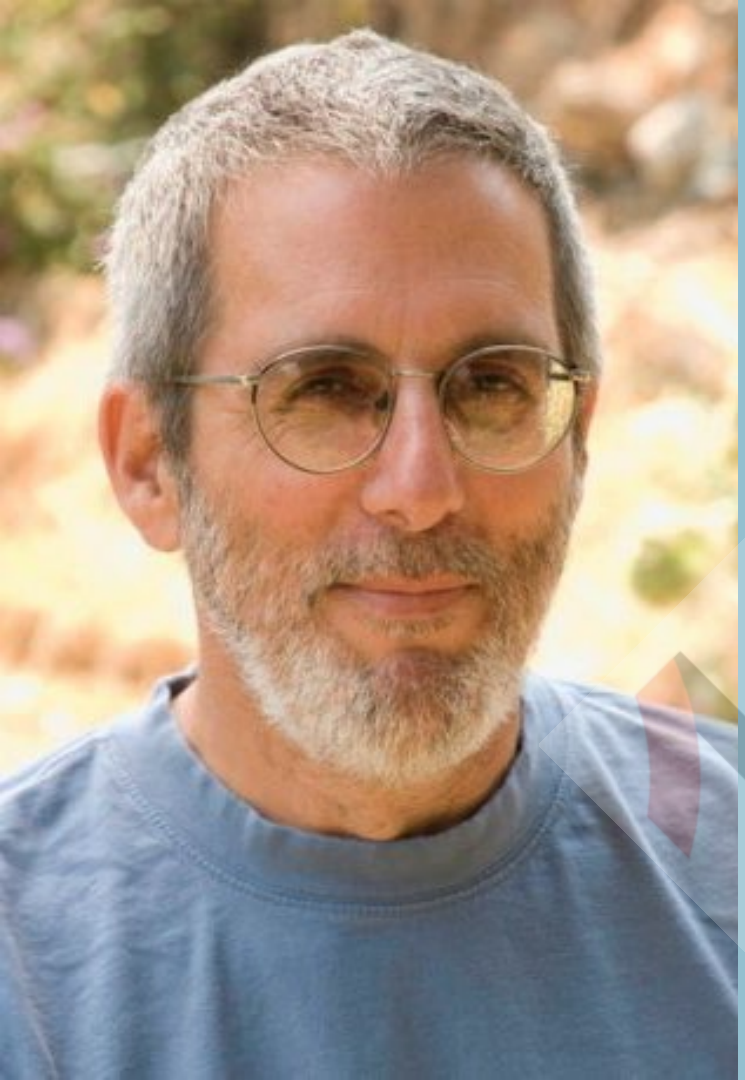
- Sign up to participate!
- Get paid for the metered energy savings of your customers

Enrollment:
3C-REN.org/contractor-participation

3C-REN
Staff Online

An Introduction to Passive House

The Passive House Network



Steve Mann

Principal, Home Energy Services
PHN Trainer
CPHD & CPHT

The Challenge

Let’s Make Architectural Solutions

- ELIMINATE CARBON : ENERGY EFFICIENCY
- PROTECT HEALTH : HYGIENIC VENTILATION
- PROVIDE RESILIENCE : SHELTER-IN-PLACE
- DELIVER AFFORDABILITY : FOR EVERYONE
- MITIGATE INVESTMENT RISK : FUTURE PROOF

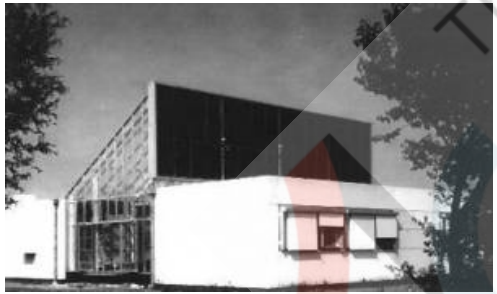
Prehistory

What came before?

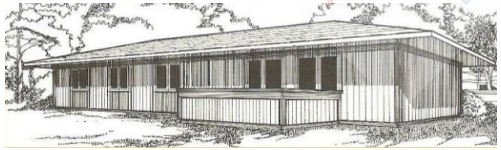
Precursors of Passive House

Vernacular, China

DTH zero-energy house, Denmark, 1973



Illinois Lo -Cal House, Wayne Shick , US 1976



Fridtjof Nansen's polar ship, the “Fram”, 1893

The Philips Experimental House, Germany, 1974

Saskatchewan Conservation House w/ Harold Orr, Canada 1977

The First Passive House (1990)

Discovery

Flipping the equation

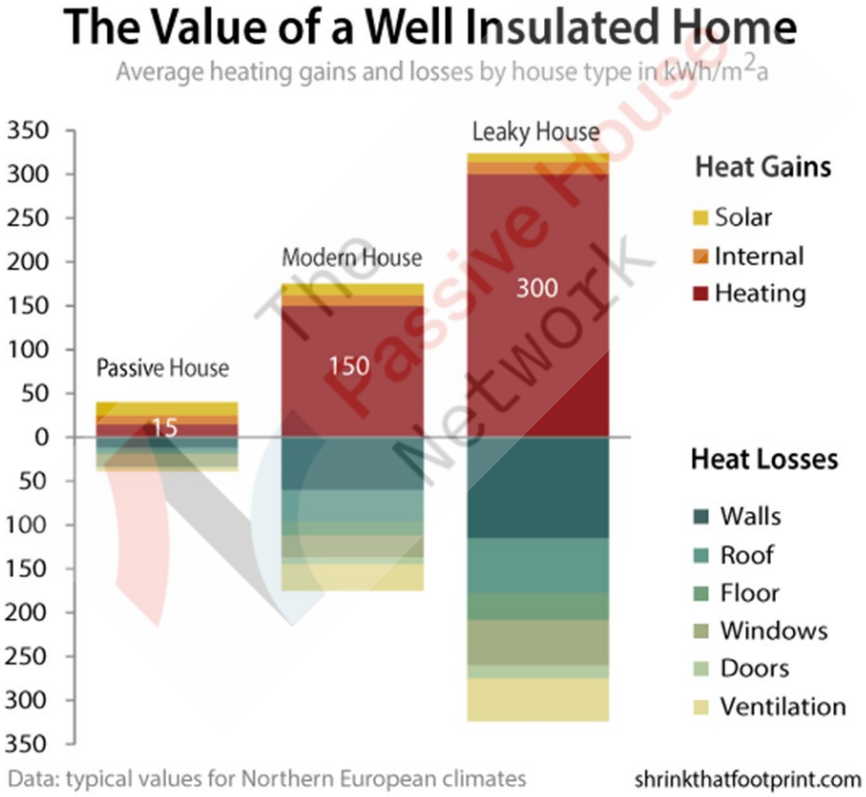
A Comfort & Health Standard

THE POWER OF A SIMPLE IDEA:

THERMAL COMFORT & HEALTH DRIVE PERFORMANCE

"Una casa pasiva es un edificio para el cual el confort térmico (ISO 7730) se puede lograr únicamente mediante el calentamiento posterior, o el enfriamiento posterior, de la masa de aire fresco requerida para lograr suficientes condiciones de calidad del aire interior, sin la necesidad de recirculación adicional de aire" – Passive House Institute, passipedia.org

Begins Energy Balance



Flip the Equation & Make High -Quality Normal

Passive House provides a clear pathway to decouple power and performance.

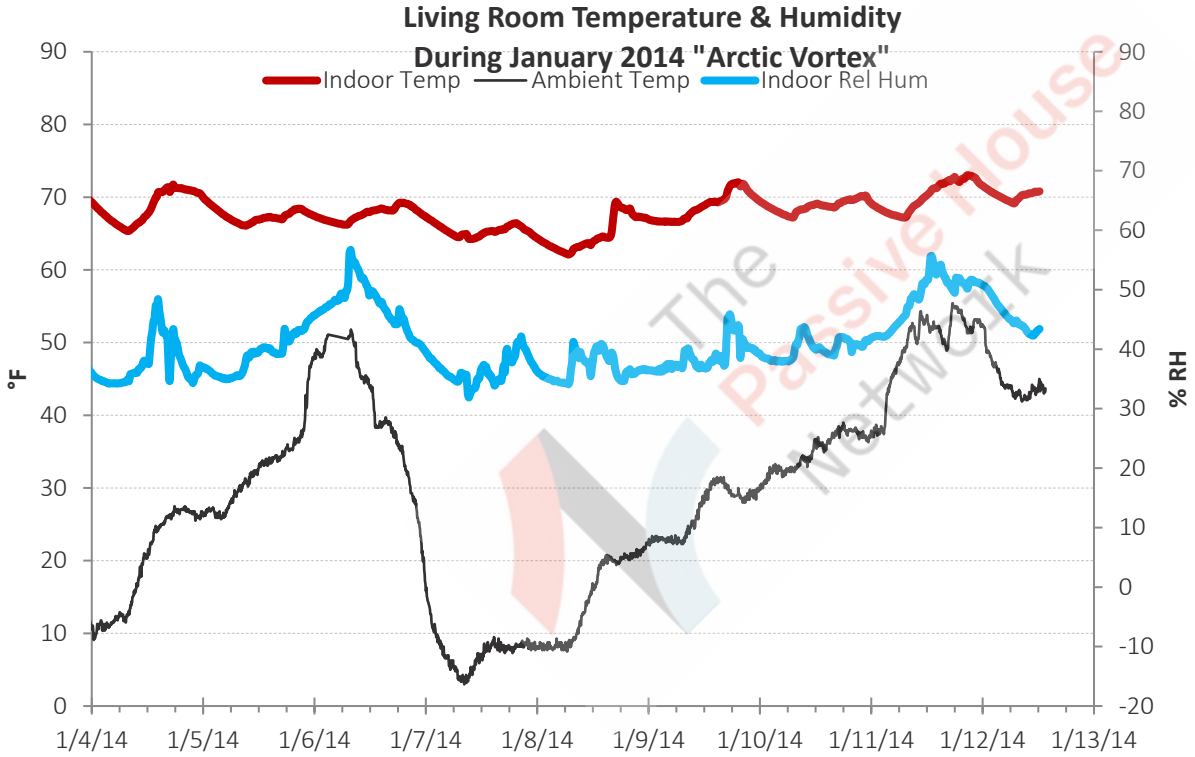
Passive Balance Provides Comfort

Steady Temperatures

Peace and Quiet

Passive Balance Provides Hygiene

Passive Balance Provides Resilience

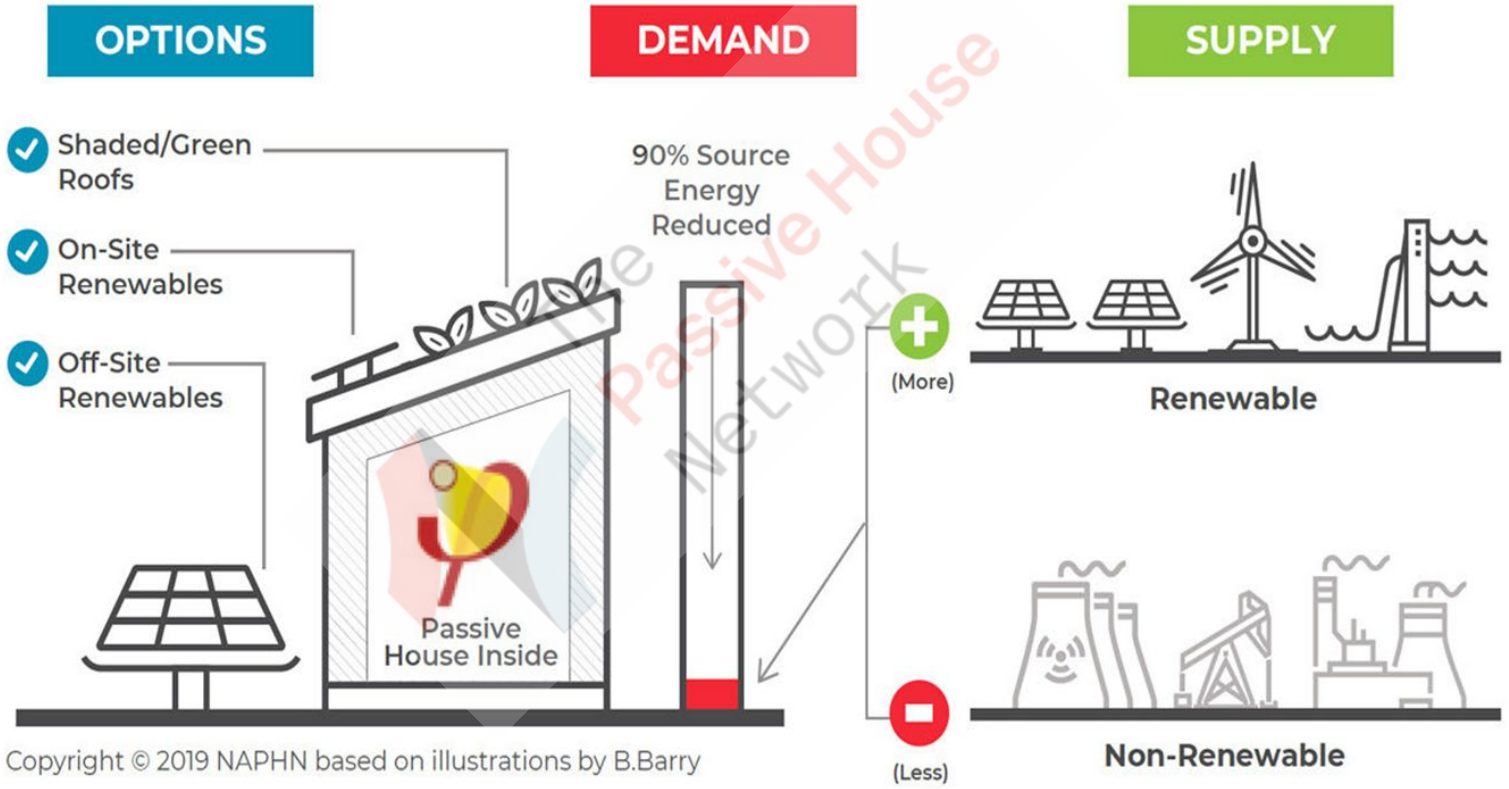


Cramer Silkworth , Baukraft Engineering, Brooklyn, NY

Passive Balance Support Equity & Security

Credit: Think! Architecture

Passive Balance Supports Green Power Change



Think & Work Differently

Flip the equation & make high quality normal

Let’s Restart

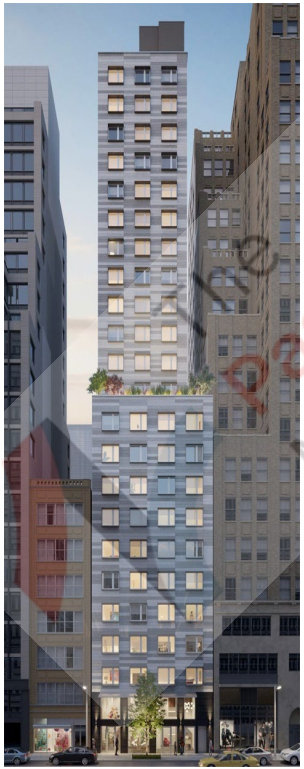
Reengage the Building Ingredients & Craft

Engage Energy Flows & Balance

Do We Have the Imagination?

Imagine New Expression

Towers: Vienna, New York, Vancouver, Boston



Garment Factory, Sri Lanka

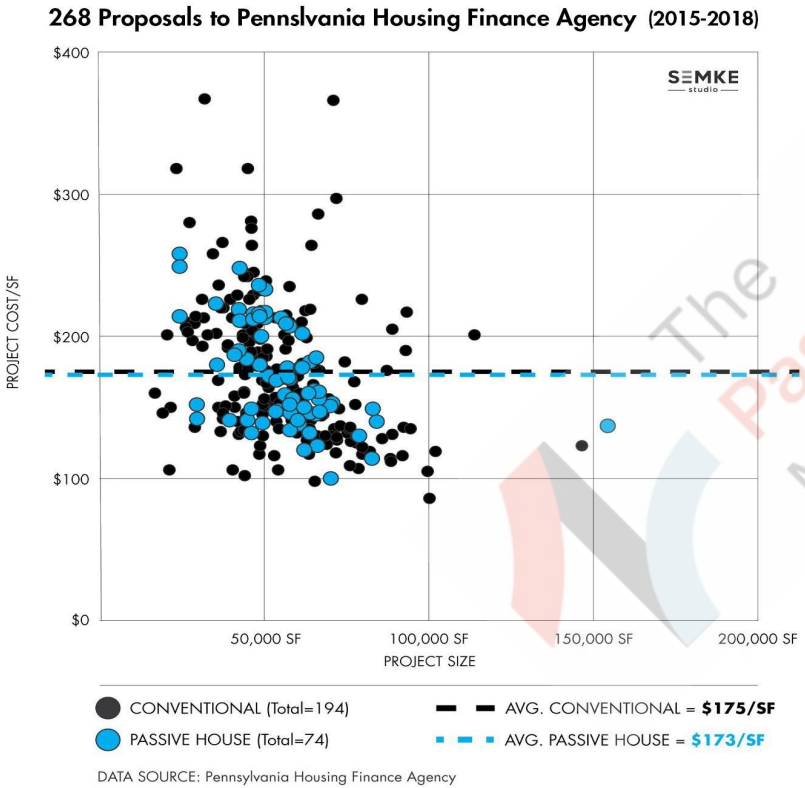
Image: JPDA. Sri Lanka Passive House Factory, 2018.

UK RIBA Sterling Prize Winner

Credit: Mikhail Riches with Cathy Hawley

How Much Does it Cost?

Not a Typical “Cost -Plus” Paradigm



INCENTIVE PROGRAMS

Low Income Housing Tax Credits

The Sleeper Simulant Policy

by Zachary Semke
Semke Studio

Stay in budget & on target:

- Passive House on day one
- Work with certifier from day one
- Require team to have proper training
- Optimize from start & stick to certification & target

How Is This Possible?

Tools Enabling Predictability

The Passive House Network

Certified Buildings:

Certified Passive House
Passive House Institute

Certified Components:

CERTIFIED COMPONENT
Passive House Institute

Certified Professionals:

CERTIFIED PASSIVE HOUSE TRADESPERSON
TRADESPERSON

Energy Model Design Tool & Manual:

Reference Materials:

Passipedia
PASSIPEDIA
The Passive House Resource

Global Research:

Passive House Institute

Global Knowledge Sharing:

International PASSIVE HOUSE Association
iPHA

www. passivehouse .com

Three Certification Levels to Passive House

Certified
Passive House
Passive House Institute
| **classic** | plus | premium |

Certified
Passive House
Passive House Institute
| classic | **plus** | premium |

Certified
Passive House
Passive House Institute
| classic | plus | **premium** |

Certified Retrofits: EnerPHit

The Passive House Network

Credit: Ryall Sheridan Architects

EnerPHit Certified Retrofit Passive House Institute | classic | plus | premium |

EnerPHit Certified Retrofit Passive House Institute | classic | plus | premium |

EnerPHit Certified Retrofit Passive House Institute | classic | plus | premium |

NACC: 13 Certifiers and Growing

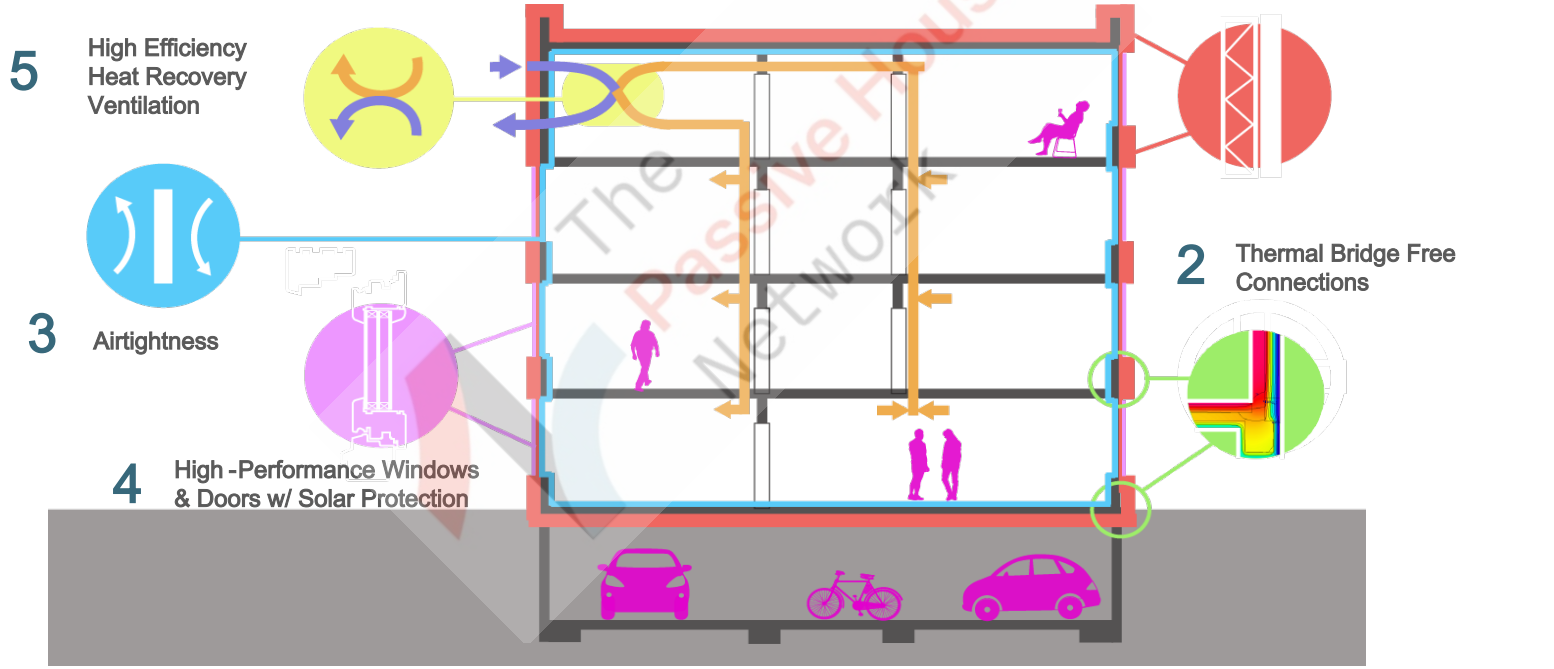
How Do You Make a Passive Building?

Futureproof architecture for the Anthropocene

An Integrated Methodology

The Passive House Network

Five Key Principles



Energy Model: Passive House Planning Package

Windows

Hollis Montessori School / Climate: Hollis, NH / TFA: 9058 ft² / Heating: 0.91 kWh/(ft²yr) / Cooling: 0.8 kWh/(ft²yr) / PER: 12.55 kWh/(ft²yr)

Window area orientation	Global radiation (main orientations)	Shading	Dirt	Non-vertical radiation incidence	Glazing fraction	SHGC	Solar irradiation reduction factor	Window area	Window U-Value	Glazing area	Average global radiation		Transmission losses heating period	Heating solar rad heating p
Standard values →	kWh/(ft²yr)	0.75	0.95	0.85				ft²	BTU/hr.ft².F	ft²	kWh/ft²yr		kWh/yr	kWh/
North	14	0.56	0.95	0.85	0.58	0.50	0.26	155	0.20	90	14	North	1642	289
East	33	0.79	0.95	0.85	0.63	0.50	0.40	155	0.19	98	41	East	1557	129
South	62	0.81	0.95	0.85	0.74	0.50	0.49	506	0.17	376	59	South	4381	725
West	34	0.81	0.95	0.85	0.63	0.50	0.41	64	0.18	40	34	West	608	446
Horizontal	53	1.00	0.95	0.85	0.00	0.00	0.00	0	0.00	0	53	Horizontal	0	0
Total or average value for all windows.						0.50	0.43	880	0.18	604			8188	927

Go to glazing list Go to window frames list

Heating degree hours [°F.day/yr]: 7440

Qua n- tity	Description	Deviation from north	Angle of inclination from the horizontal	Orien- tation	Window rough ope Width	Height	installed in Selection from 'Areas' worksheet	Glazing Selection from 'Components' worksheet	Frame Selection from 'Components' worksheet	g-Value Perpen- dicular radiation	U-Value Glazing	Frames (avg.)	Ψ Glazing edge ($\Psi_{Glazing\ edge}$ (Avg.)	Installation situ user determined value for '1': $\Psi_{installation}$ from 'Compone '0': in the case of abuttin left	right	bottom
		°	°		ft	ft		1-Sorting: LIKE LIST	Sort: AS LIST	-	BTU/hr.ft².F	BTU/hr.ft².F	BTU/hr.ft².F	BTU/hr.ft².F or 1/0		
1	W104	90	90	East	3.00	4.86	4-Wall_9351_E	01ud-Triple-insulated-Kr08	02ud SI82+Operable	0.50	0.11	0.19	0.018	1	1	1
1	W107	90	90	East	3.00	4.85	4-Wall_9351_E	01ud-Triple-insulated-Kr08	02ud SI82+Operable	0.50	0.11	0.19	0.018	1	1	1

Passive House Methodology

The Passive House Network

#1. Right-Sized Continuous Insulation:

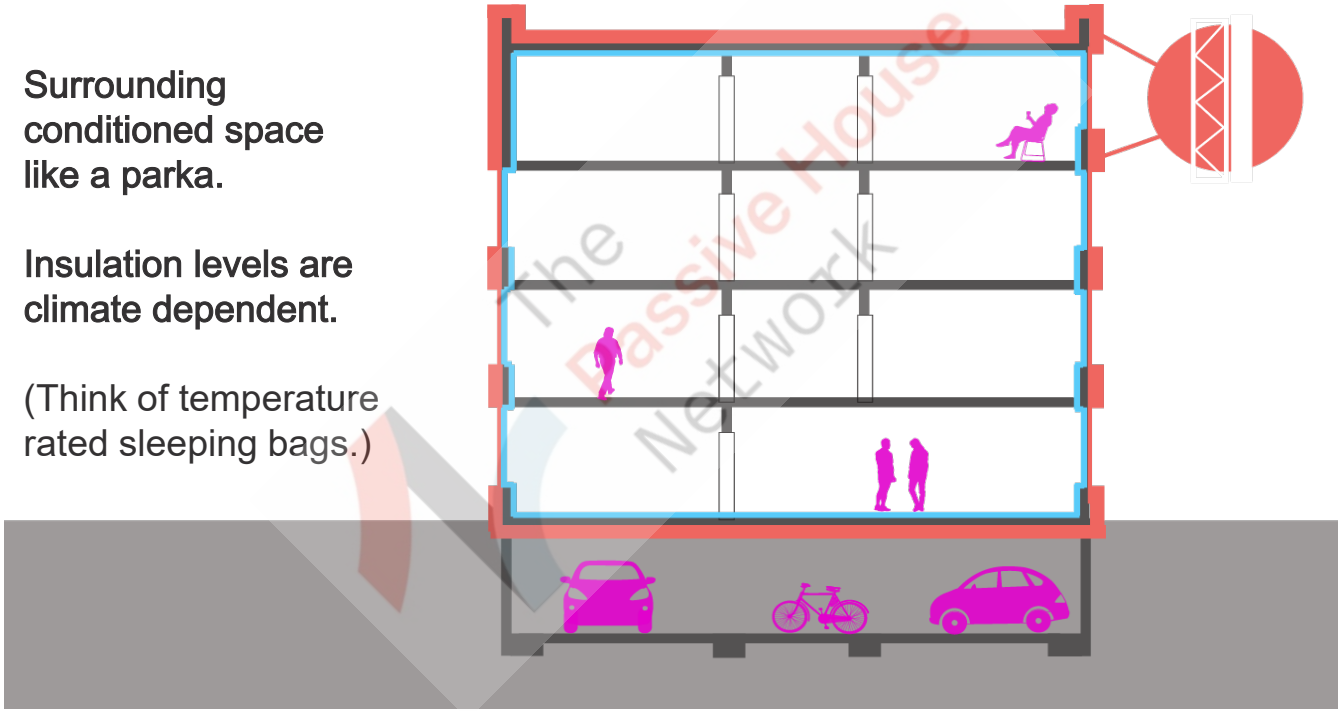
Shouldn’t you dress for the weather?

Right Sized Continuous Insulation

Surrounding conditioned space like a parka.

Insulation levels are climate dependent.

(Think of temperature rated sleeping bags.)

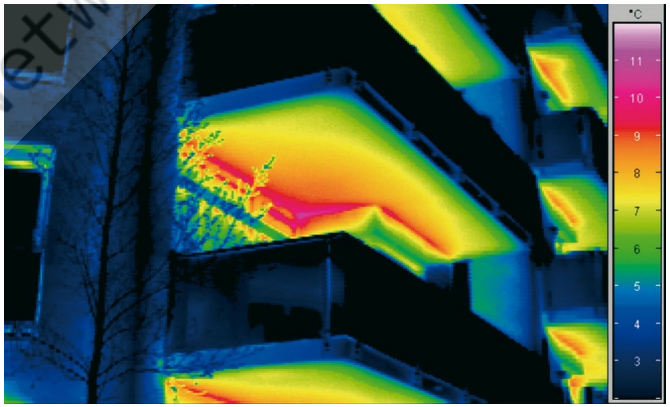


Passive House Methodology

#2. Thermal Bridge Free Enclosure:

Don’t die by a thousand cuts.
Find the power in the connections.

Cold Surfaces, Mold, Condensation, Heat Loss

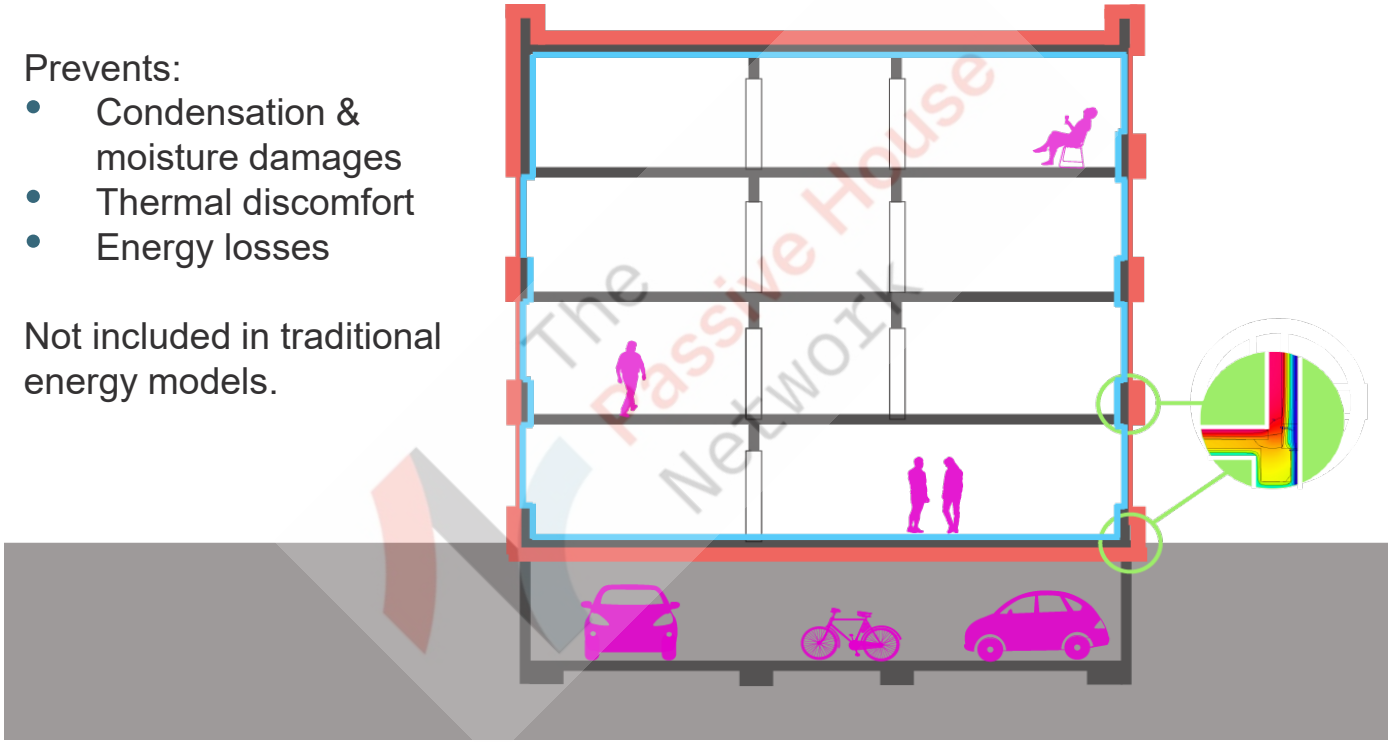


No Thermal Bridges

Prevents:

- Condensation & moisture damages
- Thermal discomfort
- Energy losses

Not included in traditional energy models.



Eliminate and calculate lowers risks and increases predictability.

Methodology

#3. An Airtight Enclosure:

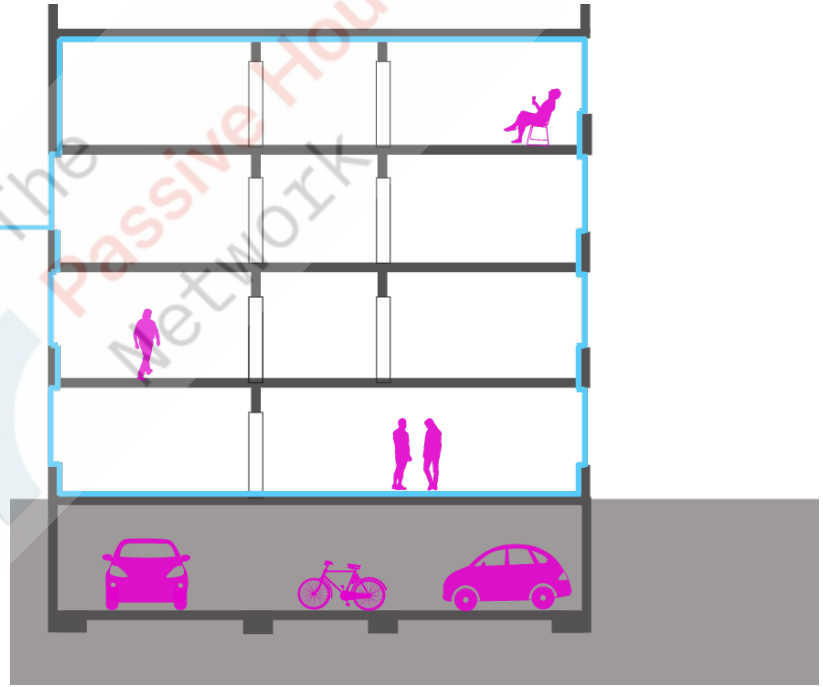
No, it's not suffocating.
It's Liberating!

Make it Airtight: Continuous Air barrier

Airtightness is a driving force of performance.

- Reduce drafts
- Reduce possibility of moisture damage to envelope

- Reduce heat loss (winter)
- Reduce humidity (summer)
- Provides peace & quiet
- Supports healthy indoor air



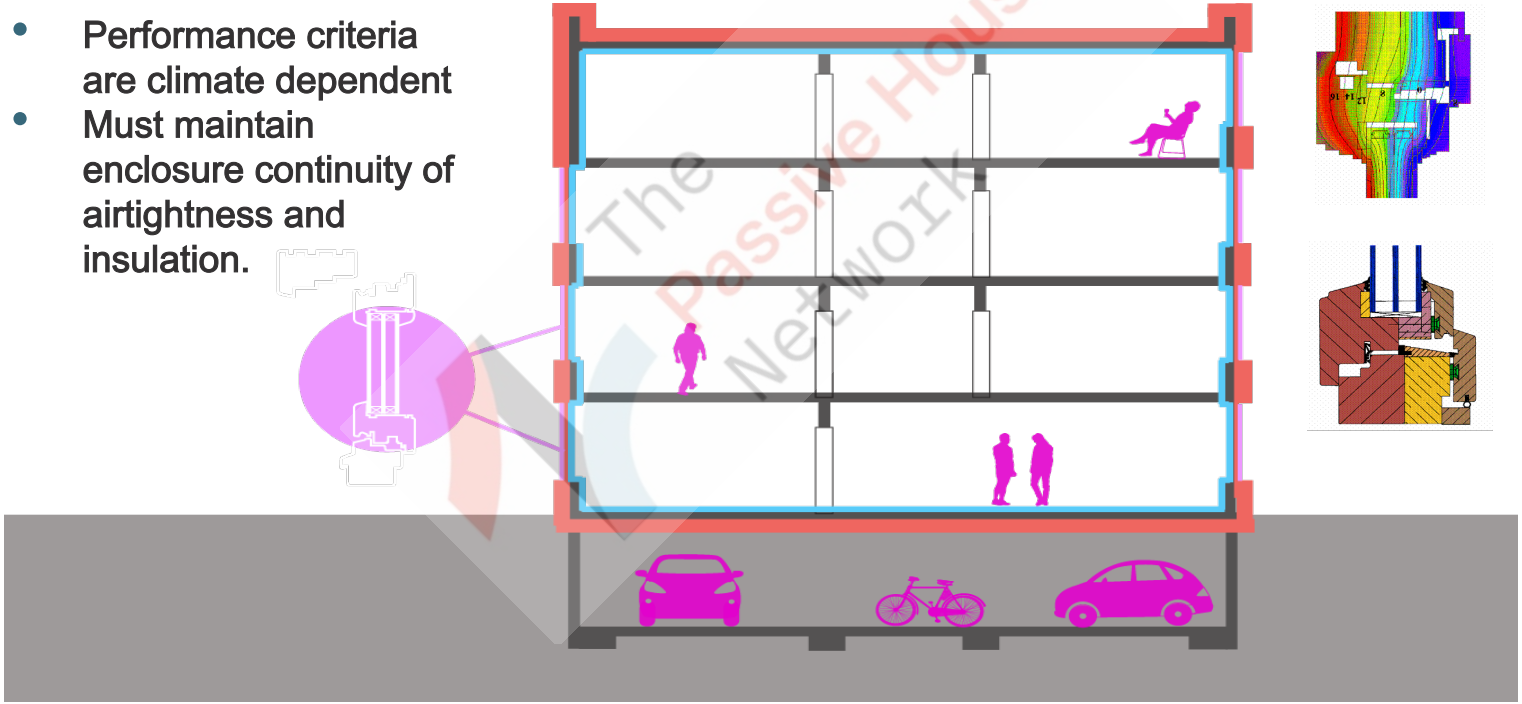
Passive House Methodology

#4. High -Performance Windows & Doors with Solar Protection:

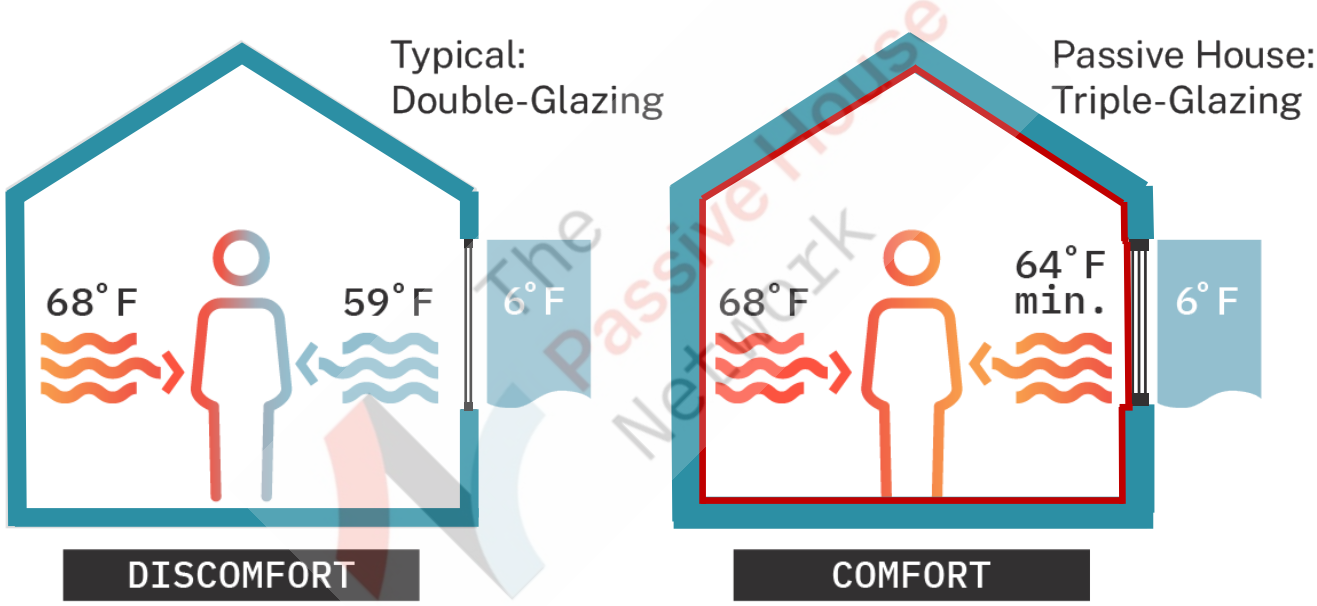
Not a “Passive Solar” Building. Show-off restraint & balance.

Be Smart with Windows and Shading

- Performance criteria are climate dependent
- Must maintain enclosure continuity of airtightness and insulation.



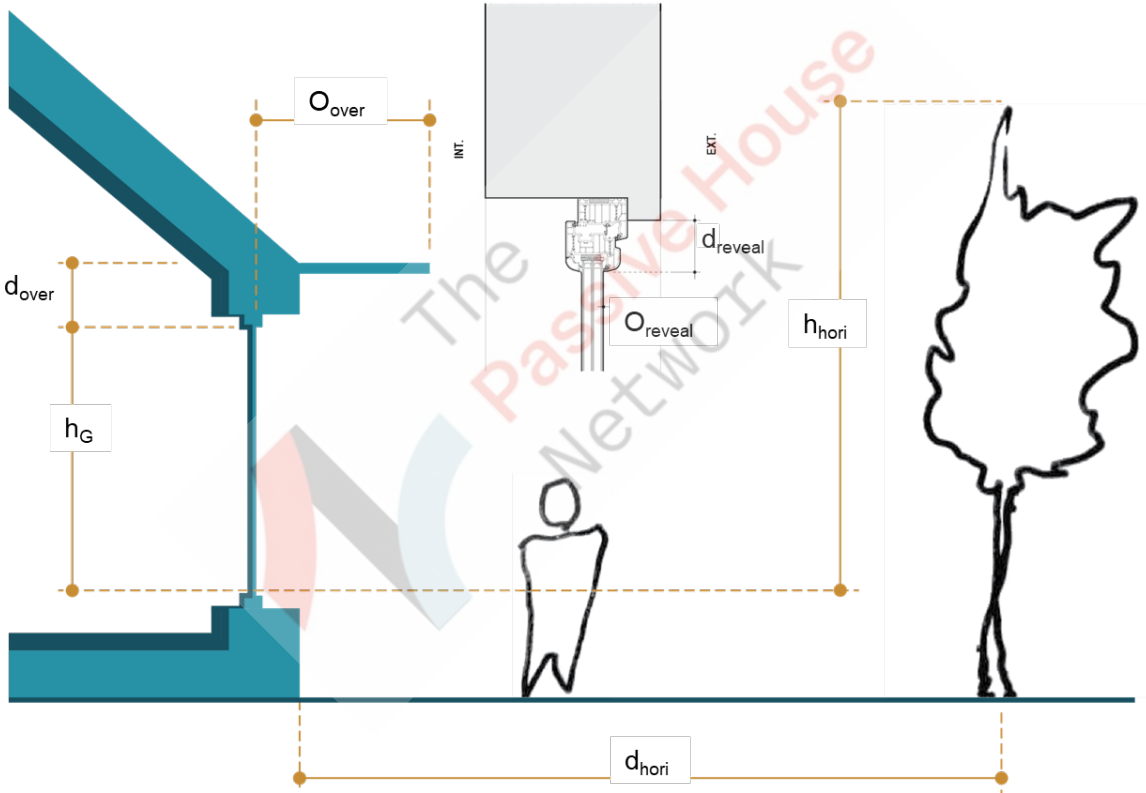
Thermal Continuity = Comfort



Even temperatures allows removal of perimeter mechanical systems

Thermal Continuity = Comfort

Shading to Be Considered



Credit: BLDGtyp

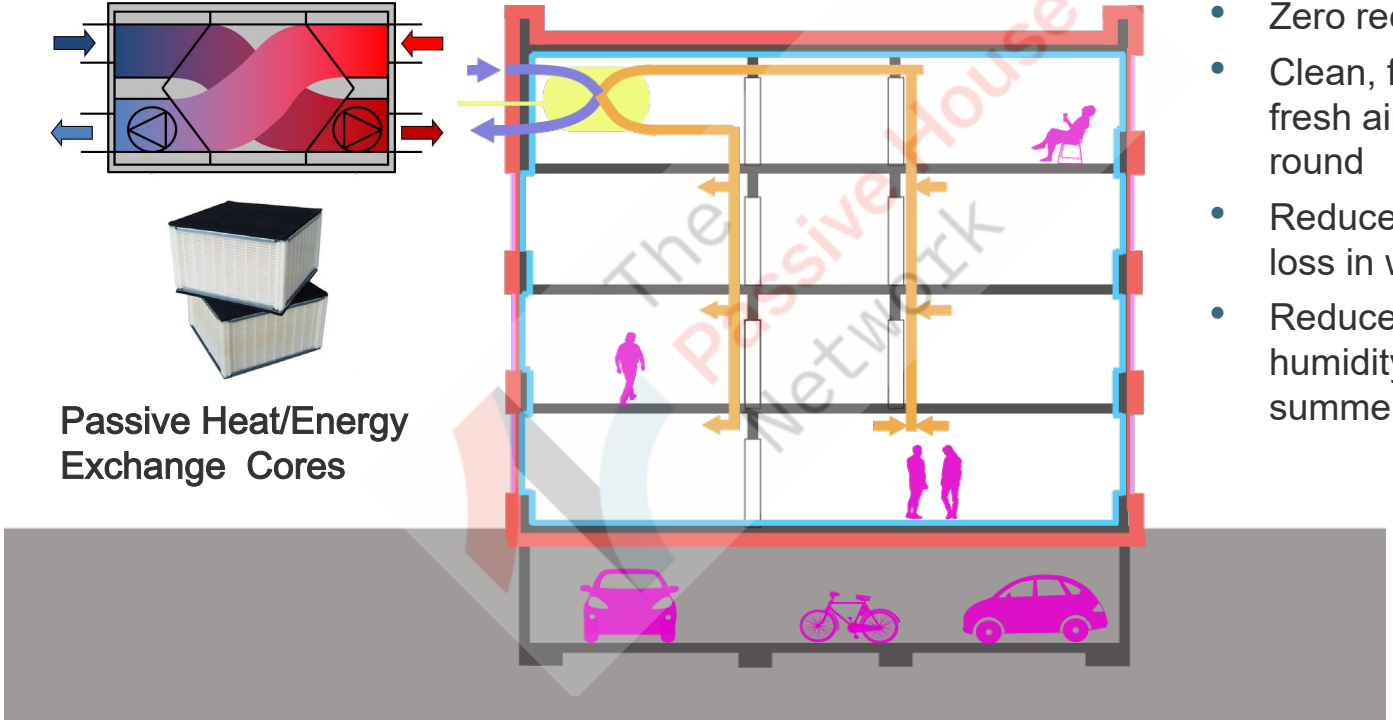
Passive House Methodology

#5. High -Efficiency Heat Recovery Ventilation:

Hygienic Ventilation is a foundational goal

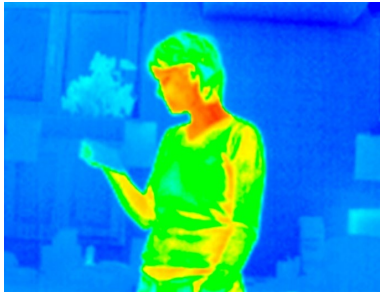
Original Concept: Hygienic Ventilation

Passive Heat/Energy Exchange Cores



- Zero recirculation
- Clean, filtered fresh air all year round
- Reduced heat loss in winter
- Reduced humidity in summer

Optimize Passive Internal Heat Gains



People

Appliances & Equipment

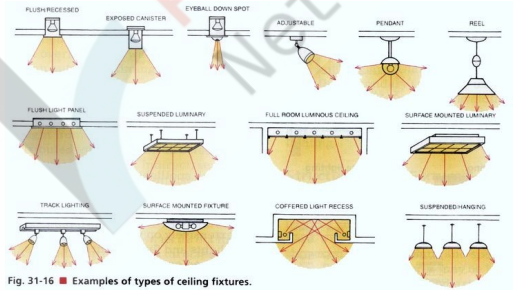


Fig. 31-16 ■ Examples of types of ceiling fixtures.

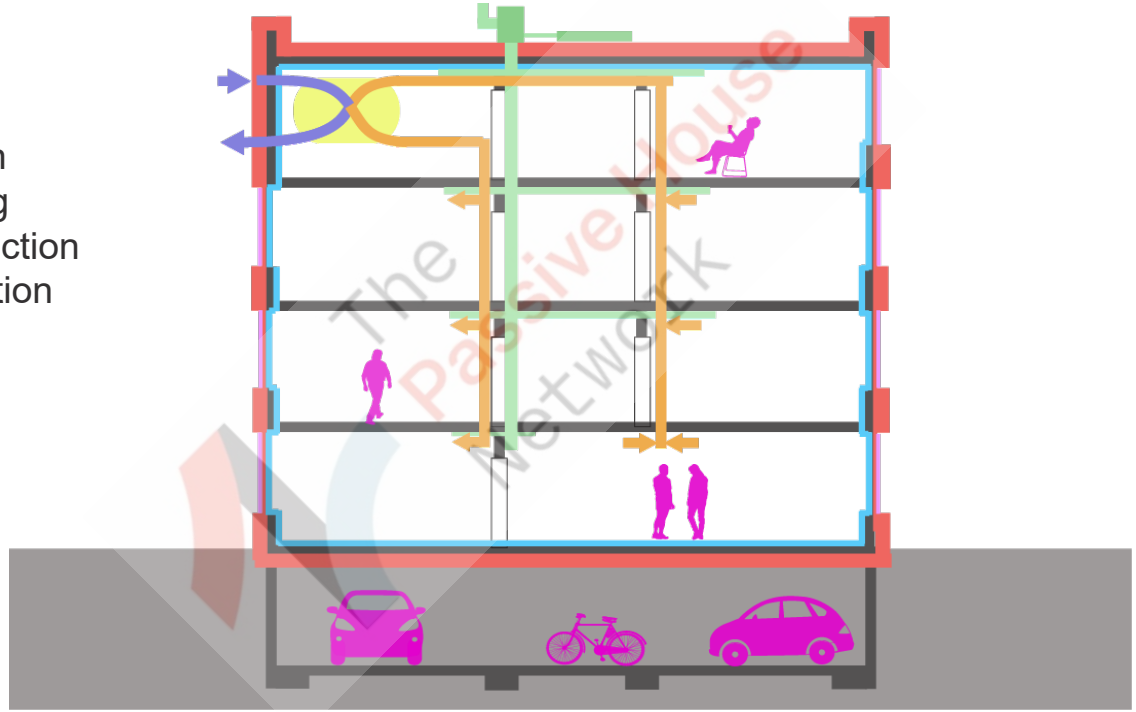
Lighting & Mechanical Systems

Active Heating, Cooling & Dehumidification?

Typically, likely & maybe.
(It’s an optimized building not a magical one)

Right Size the Heating and Cooling

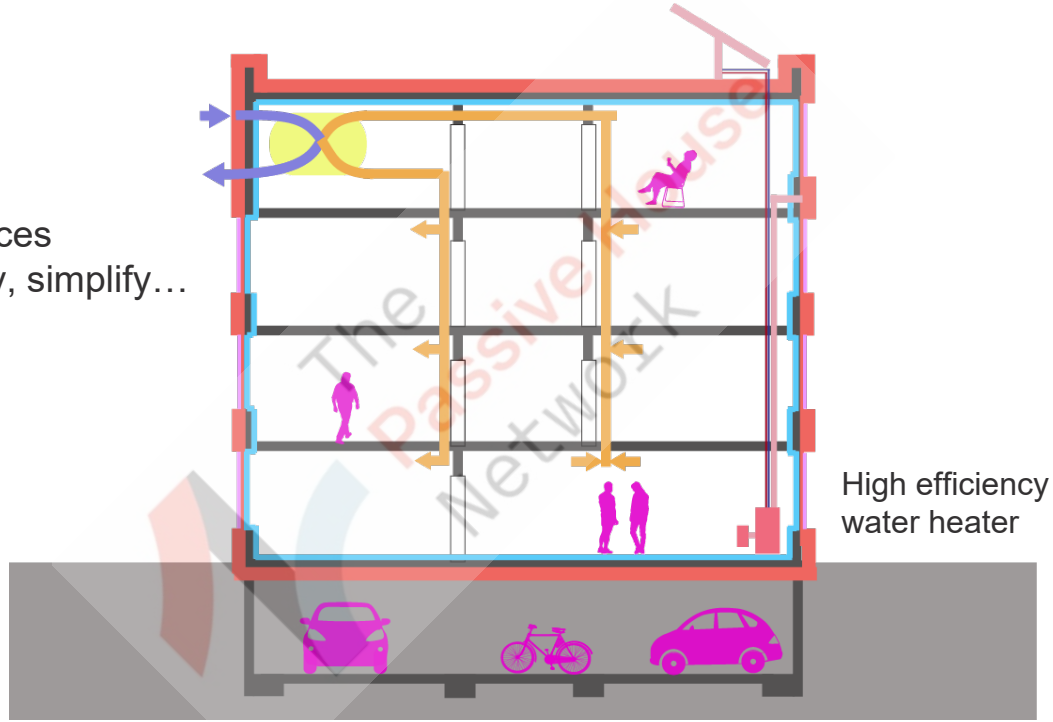
- 75% reduction in equipment sizing
- 90% usage reduction
- Efficient distribution
- Often all electric



Typical to pull distribution to core of building.

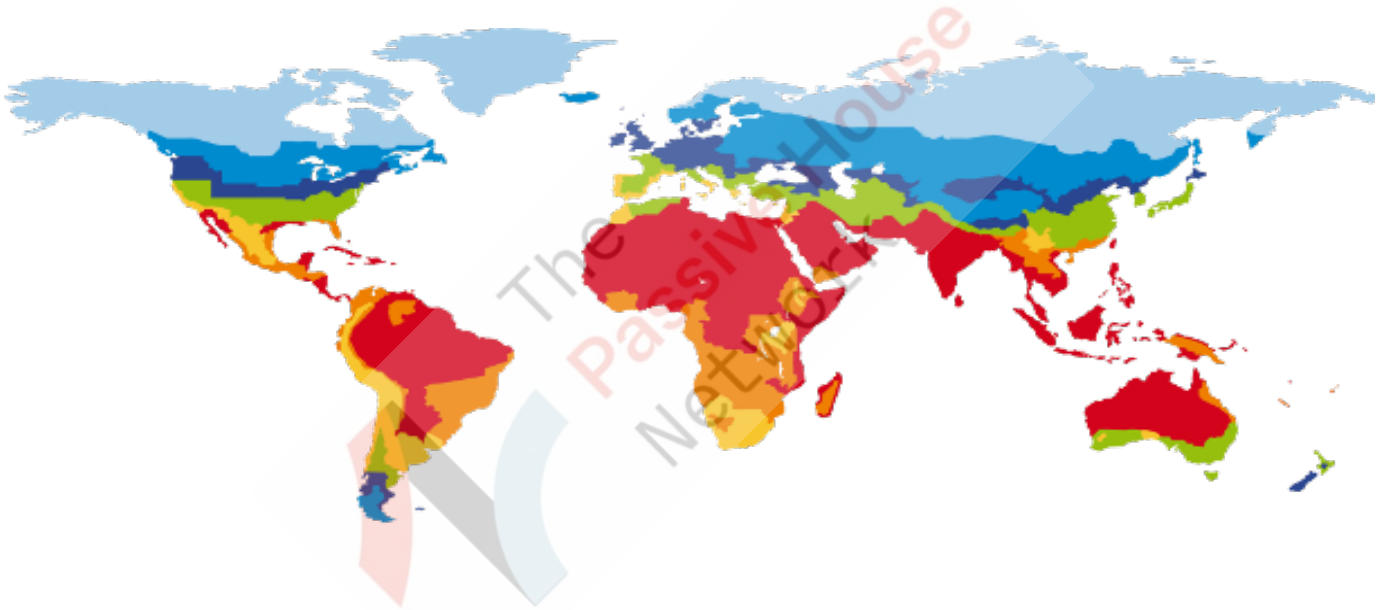
Efficient Systems & Smart Systems

- Efficient lighting
- Efficient appliances
- Simplify, simplify, simplify…



Smart systems should enhance high -performance,
not compensate for poor performance.

Global Application



Basic principles have local solutions.

China

United Kingdom

Congo: Belgian Embassy

Australia: University Building for Technology & Design

Pennsylvania

Vermont: Musicians Retreat

Vermont

Let’s Seize the Power of Buildings with Passive House

The Passive House Network

Global Knowledge. Regional Context. Local Application

THANK YOU

www.naphnetwork.org

The Passive House Network

Passive House Institute

International PASSIVE HOUSE Association iPHA

North American Certifiers Circle — Passive House Certifier

Upcoming Training

Seize the power of Passive House.

Closing

- Continuing Education Units Available
  - Contact shuskey@co.slo.ca.us for AIA LU/ HSW
- Coming to Your Inbox Soon!
  - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
  - March 8 - 2022 Energy Code: Accessory Dwelling Units (ADUs)
  - April 6 - 2022 Energy Code: Multi-Family
  - April 6 - High Performance Buildings & Careers – Class 1: High Performance Fundamentals Series
  - April 11 - Heat Recovery Ventilation in Existing Multifamily Buildings
  - April 18 - Electrification Products for the Central Coast Climate
  - April 20 - Using Building Science to Design and Build High Performance Homes – Class 2: High Performance Fundamentals Series

Thank you!

For more info:
3c-ren.org

For questions:
info@3c-ren.org

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SAN LUIS OBISPO • SANTA BARBARA • VENTURA