



North American
Passive House
Network

www.naphnetwork.org

An Introduction to Passive House: Cornerstone of Our Post Carbon Future

ICC, Los Angeles Basin Chapter – November 14th, 2019



Xavier GAUCHER

Certified Passive House Consultant
Owner / Builder of the Perlita PH

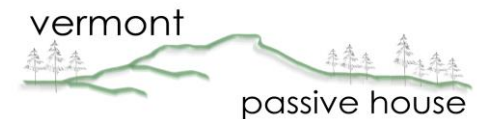


Co-President
Passive House California



Contact info: (626) 524 0505 – xgaucher@gmail.com

NAPHN: A Continental Network



in support of professionals working with the
international Passive House Standard



2 - THE PASSIVE HOUSE STANDARD

THE INTERNATIONAL LEADING LOW ENERGY BUILDING STANDARD

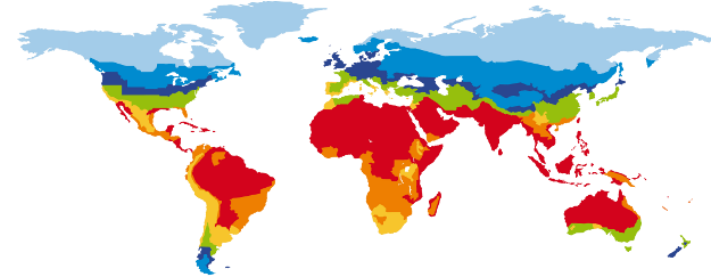
1st Modern Passive House: 1990



A reliable method to design new constructions & retrofit existing buildings



More than 85,000 buildings of all kinds around the world in every climate zone



26-Story Passive House Building: 2017

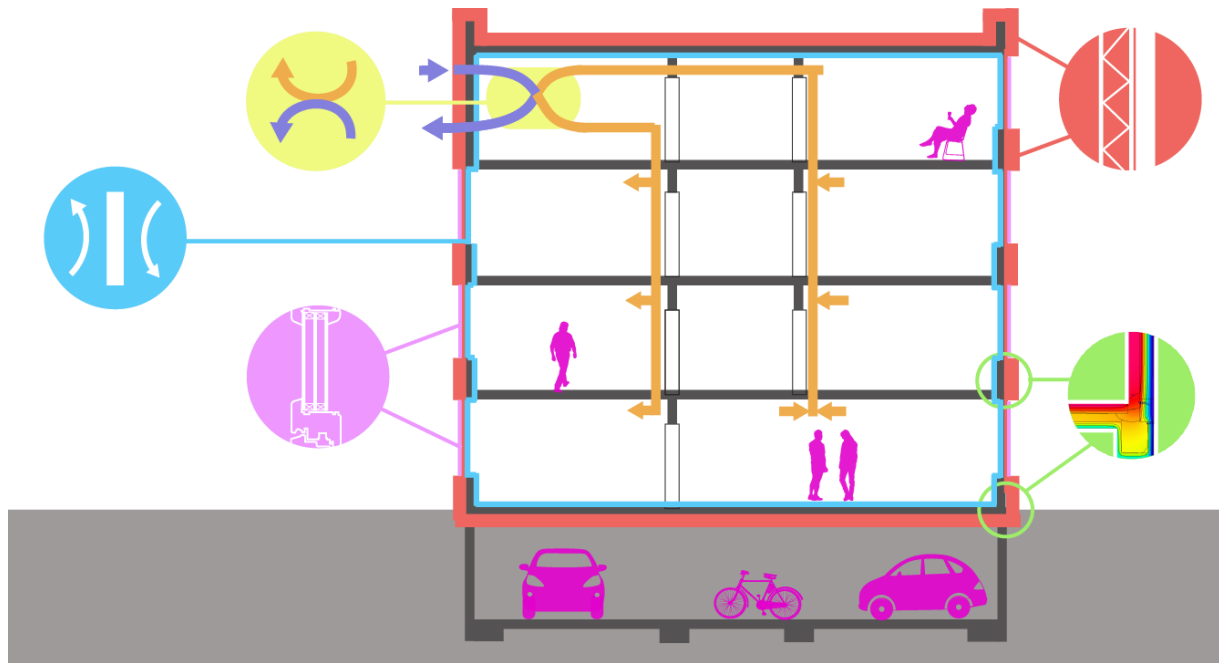


Comfort Drives Performance



PASSIVE HOUSE FUNDAMENTALS

A Passive House is a building that requires very little heating or cooling energy to deliver a high level of occupant comfort.



Primary Features:

1. Highly Efficient
2. Excellent Comfort
3. Superior Health

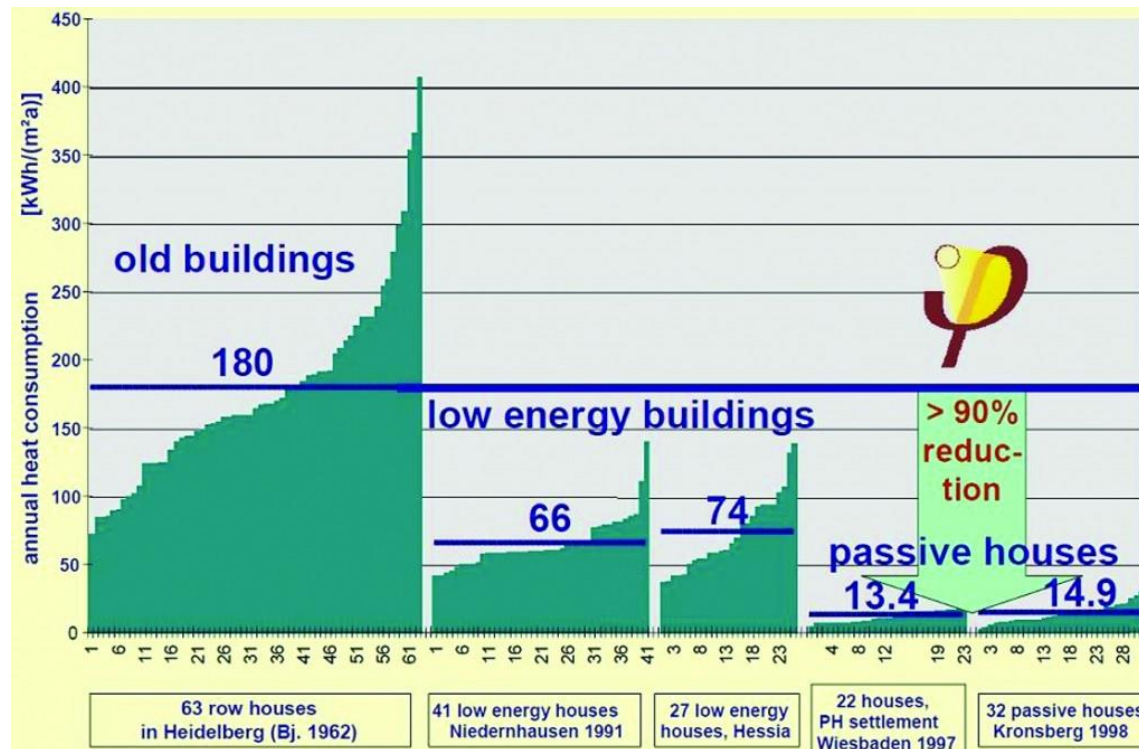
Outcomes are:

1. Energy affordability
2. Resiliency
3. Grid Stability
4. Very low emissions
5. Supports renewables

RESULTING IN DRAMATIC ENERGY SAVINGS

Approx **90%**
reduction in heating & cooling

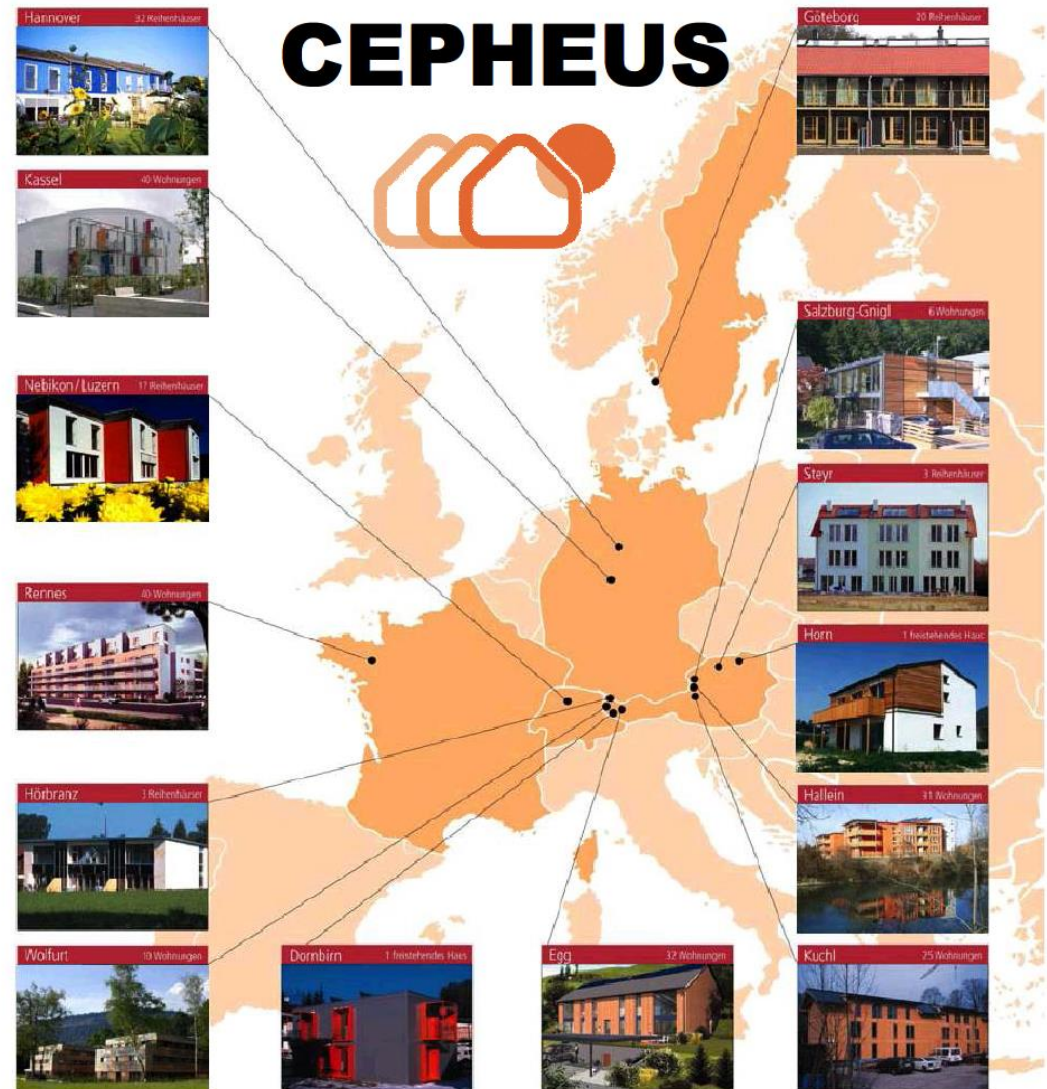
Up to **75%**
reduction in total energy usage.



VERIFICATION OF METHODOLOGY

2000:

250 dwelling units
in 14 different
building projects
as Passive House
Buildings



COMPLEX BUILDINGS IN VARIED CLIMATES



RETROFIT OF EXISTING BUILDINGS

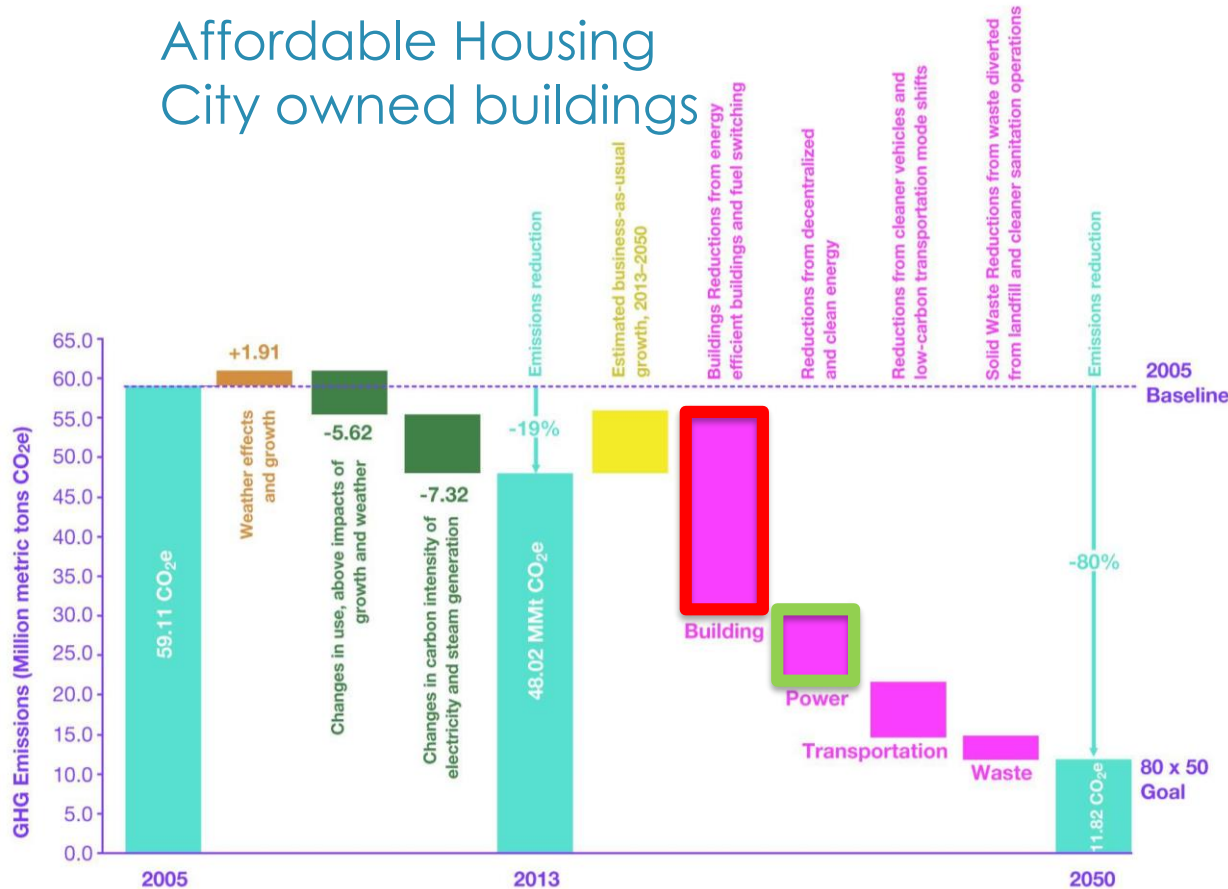


New York: 80 x 50 adopted by city & state

Incentives & Mandates:

Affordable Housing

City owned buildings



Vancouver, British Columbia:

Plan to decarbonize
Incentives & Mandates –
Zoning
Building codes



BOLD IMPLEMENTATION

BRUSSELS, 2015: All buildings, private, public, new and retrofitted **mandated** Passive House performance.



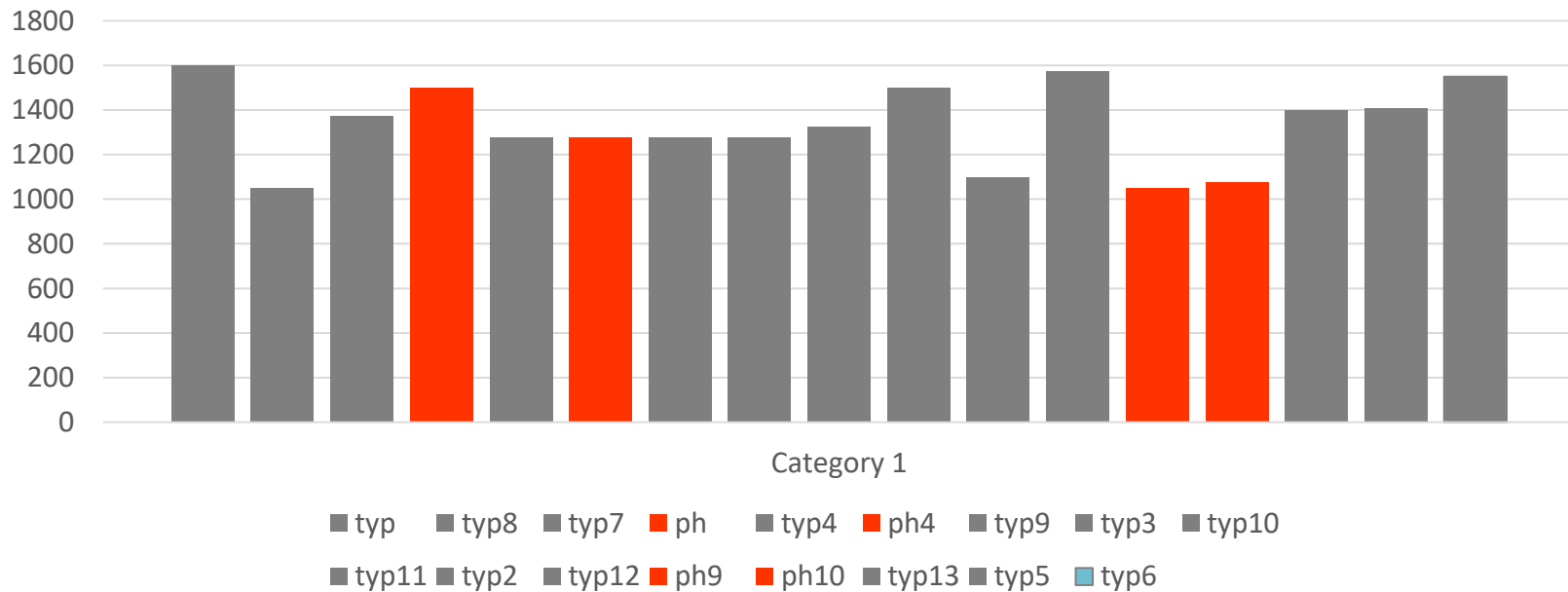
EUROPE, 2020:

Nearly zero-energy buildings.



NOT A TYPICAL “COST-PLUS” PARADIGM

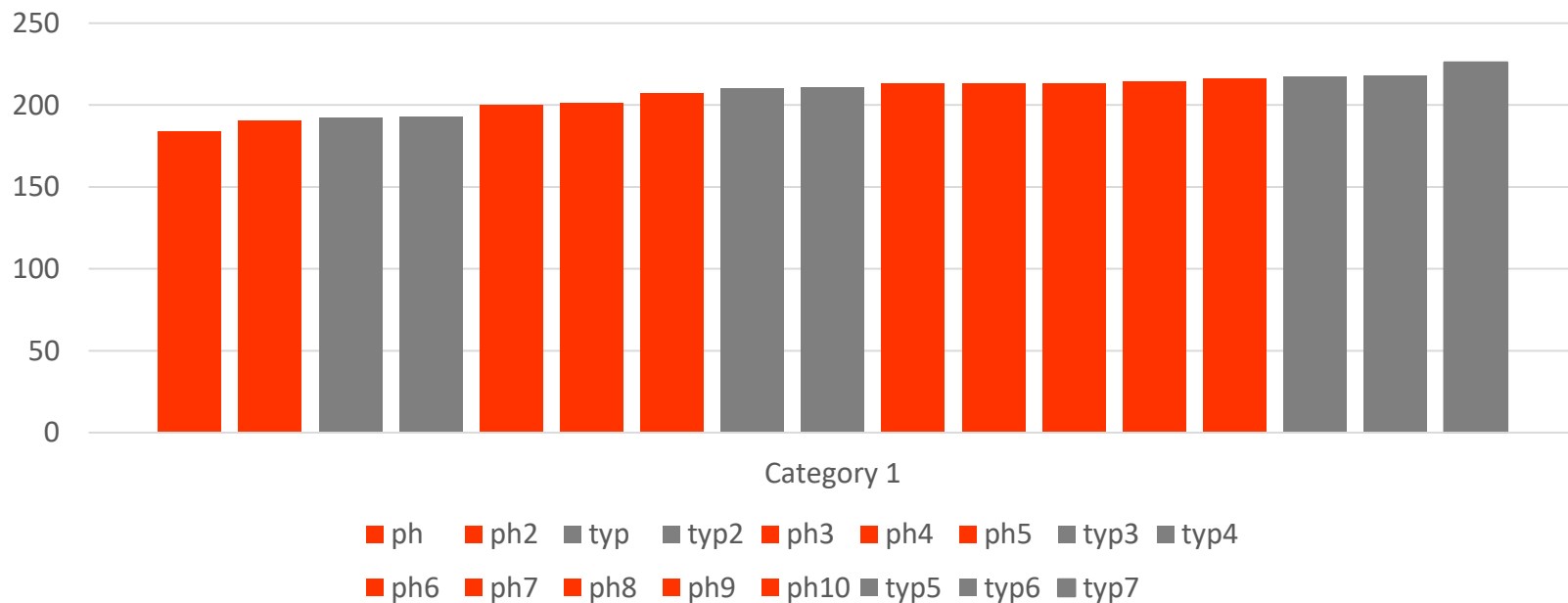
Brussels: City Block Multi-Use Complex – Competitive Design-Build Bids



eu 1,225/m2 vs. eu 1,362/m2 average

NOT A TYPICAL “COST-PLUS” PARADIGM

PHFA Multifamily Housing Around Philadelphia Region = 17 Buildings



\$206/sf vs. \$208/sf average

Integrated Goals & Methodology:

1. Focus on Passive Elements:

- Orientation
- Massing
- Insulation
- Airtightness
- Windows
- Doors
- Passive Heat Gains

2. Fixed Performance Goals:

- **Heating:** 4.75Kbtu/sf2*a demand or 3.17 btu/hr*sf **peak load**
- **Cooling & Dehumidification:** 4.75Kbtu/sf2yr + climate specific dehumidification
- **Primary Energy:** ~38Kbtu/ft2yr*
- **Airtightness:** tested limit 0.6 ACH50

3. Calculated Energy Balance:

- **Passive House Planning Package (PHPP)**



“Peak Load Equivalent”
For 1,000 sq ft house

-
- * This is the original “Source EUI” metric. The calculation now is for Primary Energy Renewable (PER) and is no longer directly comparable to EUI but still roughly corresponds to this original number for Passive House Classic certification.

Tools enabling predictability:

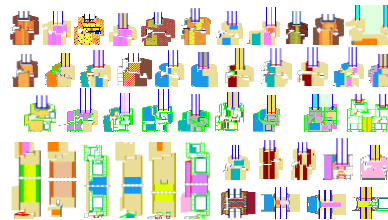
Certified Professionals:



Energy Model Design Tool & Manual:



Certified Components:



Certified Buildings:



Reference Materials:

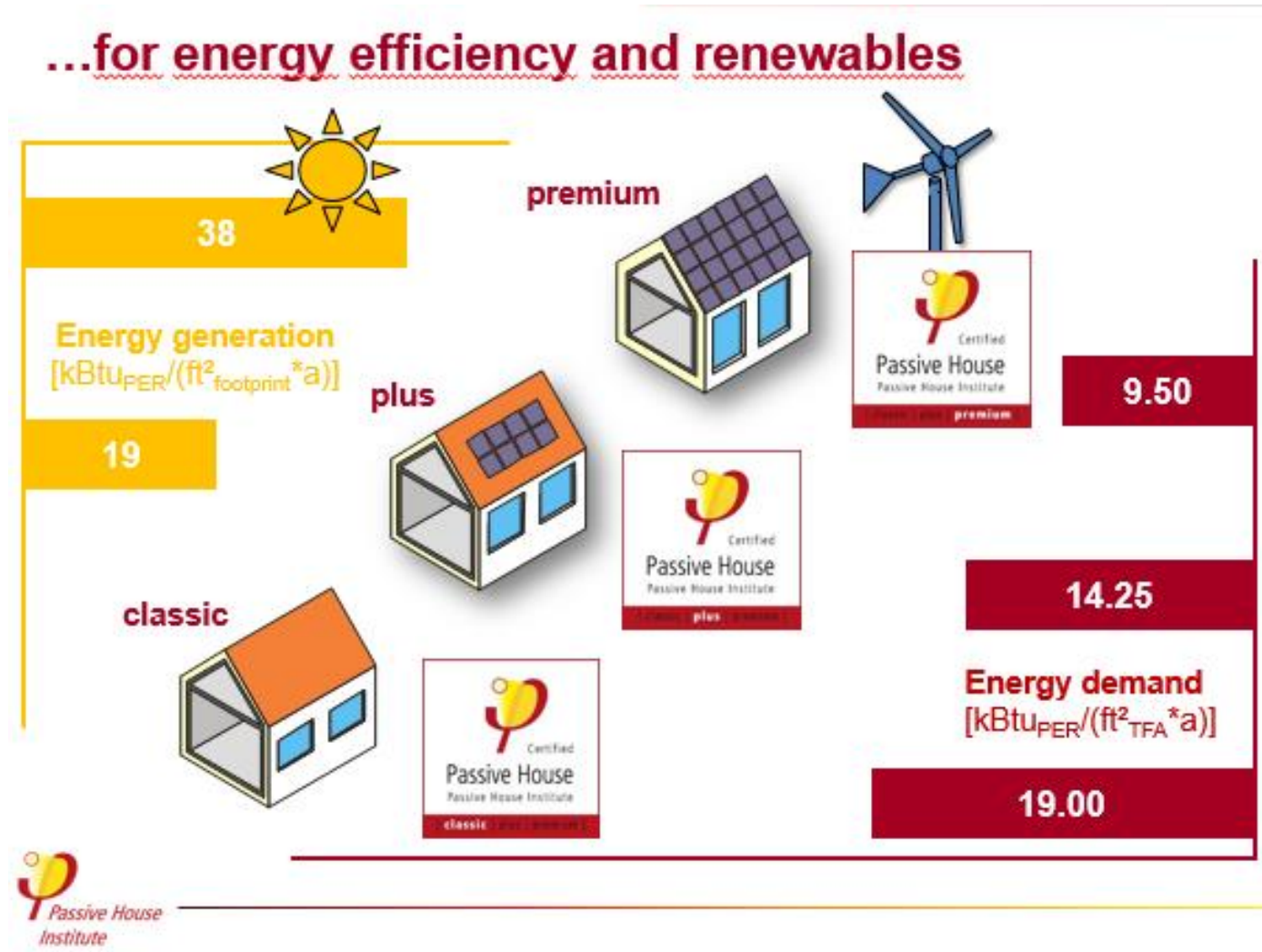


Global Research:



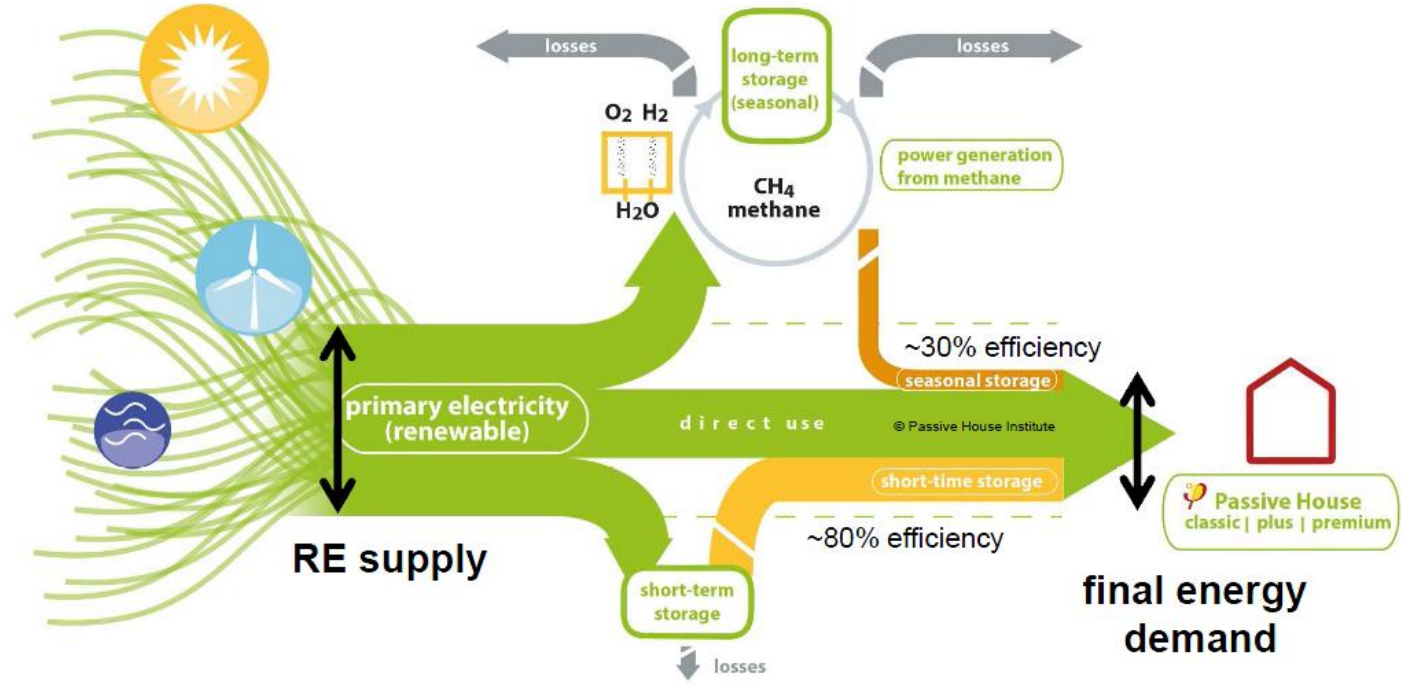
www.passivehouse.com

METRICS FOR NEW-BUILD CERTIFICATION





$$\text{PER-factor} = \frac{\text{Energy supplied from RE sources}}{\text{Finaly energy demand}}$$

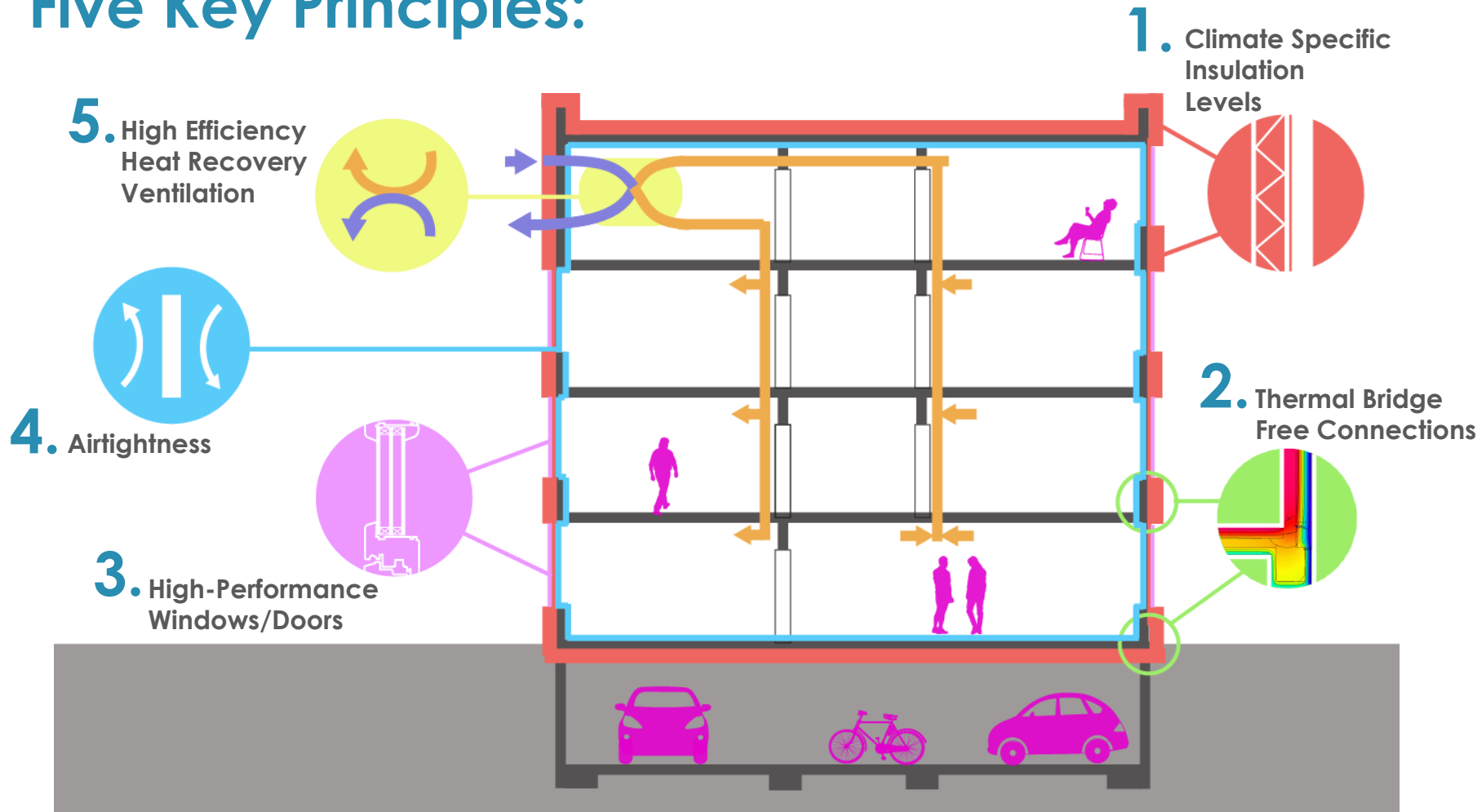


PH meets Net-Zero – PER, Plus and Premium Passive - October 2015 – Vancouver

Most of what will be, has
already been built.



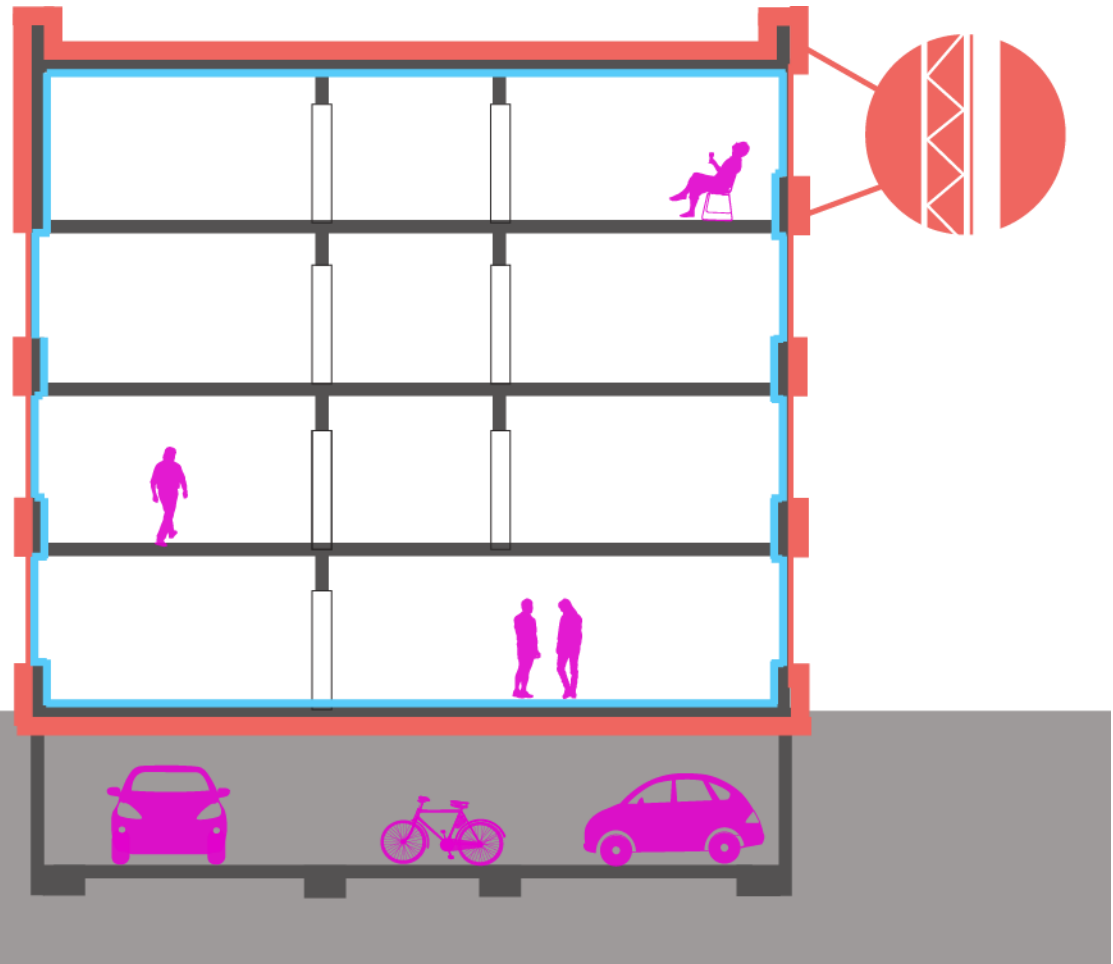
Five Key Principles:



1. CONTINUOUS INSULATION

**Insulation levels are
climate dependent.**

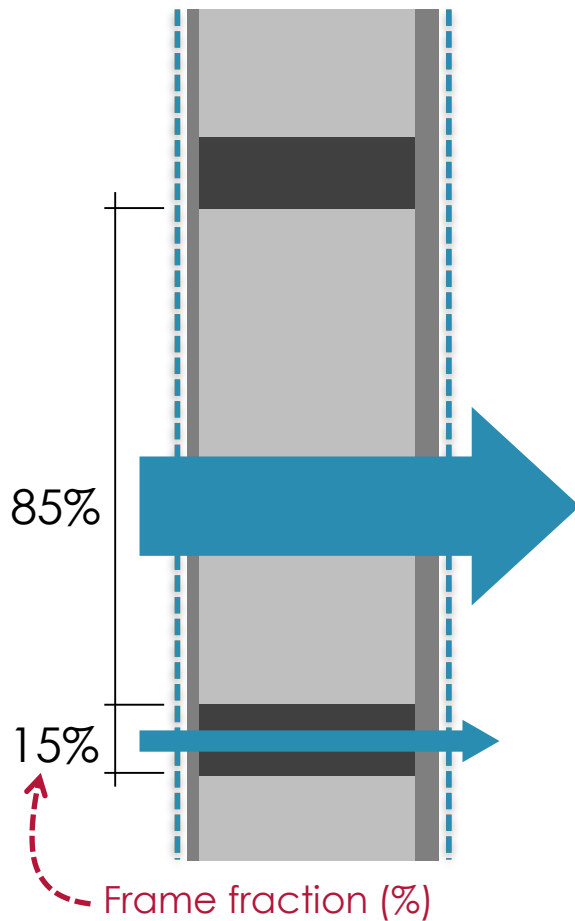
(Think of temperature
rated sleeping bags.)



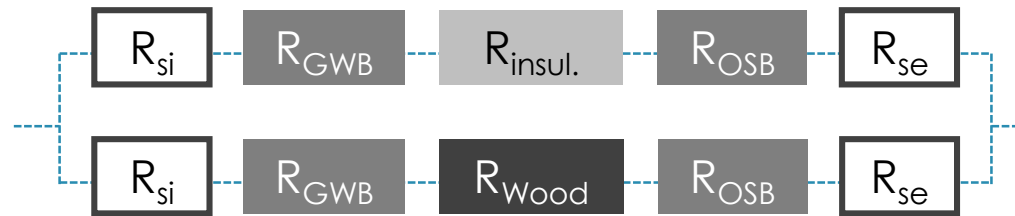
Surrounding enclosed space like a parka.

CALCULATING R-VALUES (HETEROGENEOUS ASSEMBLIES)

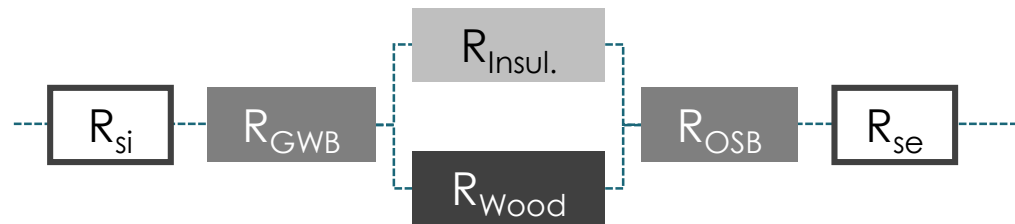
$$R_{\text{Overall}} = (R_{\text{Parallel Path}} + R_{\text{Isothermal Planes}}) / 2$$



Parallel Path Method:



Isothermal Planes Method:

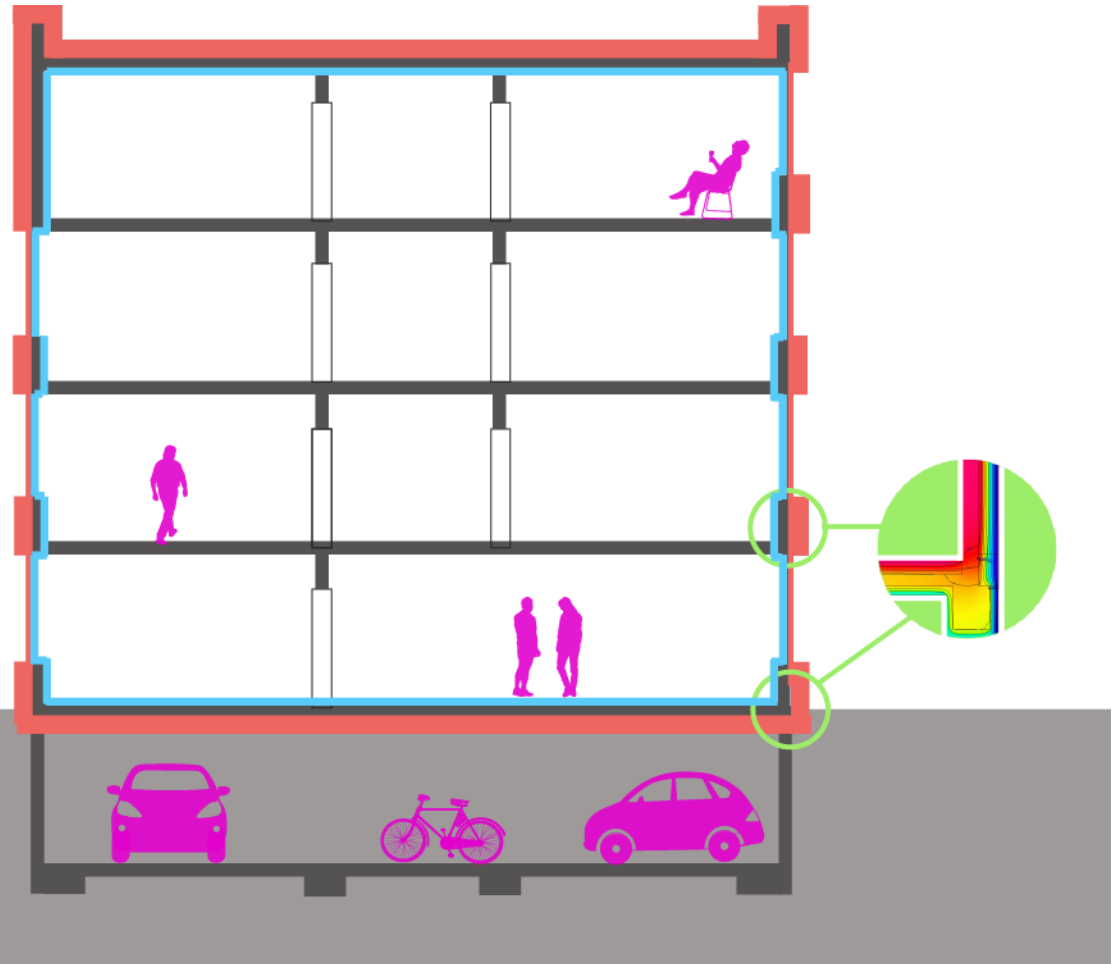


2. NO THERMAL BRIDGES

Prevents:

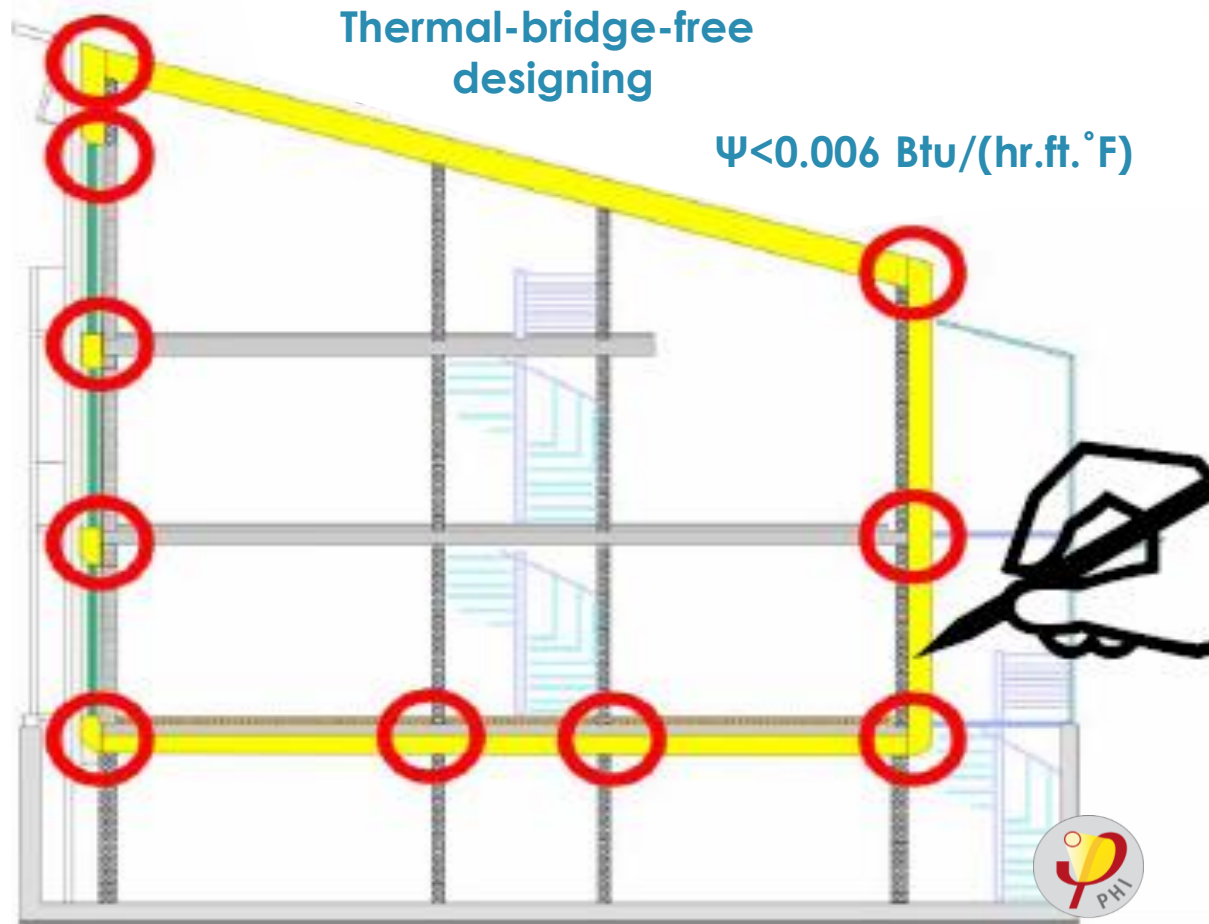
- Condensation & moisture damages
- Thermal discomfort
- Energy losses

Not included in traditional energy models.



Eliminate and calculate: lowers risks and increases predictability.

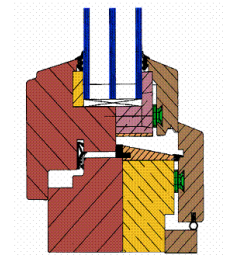
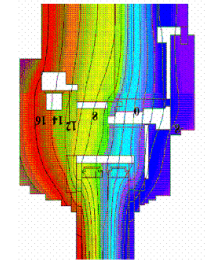
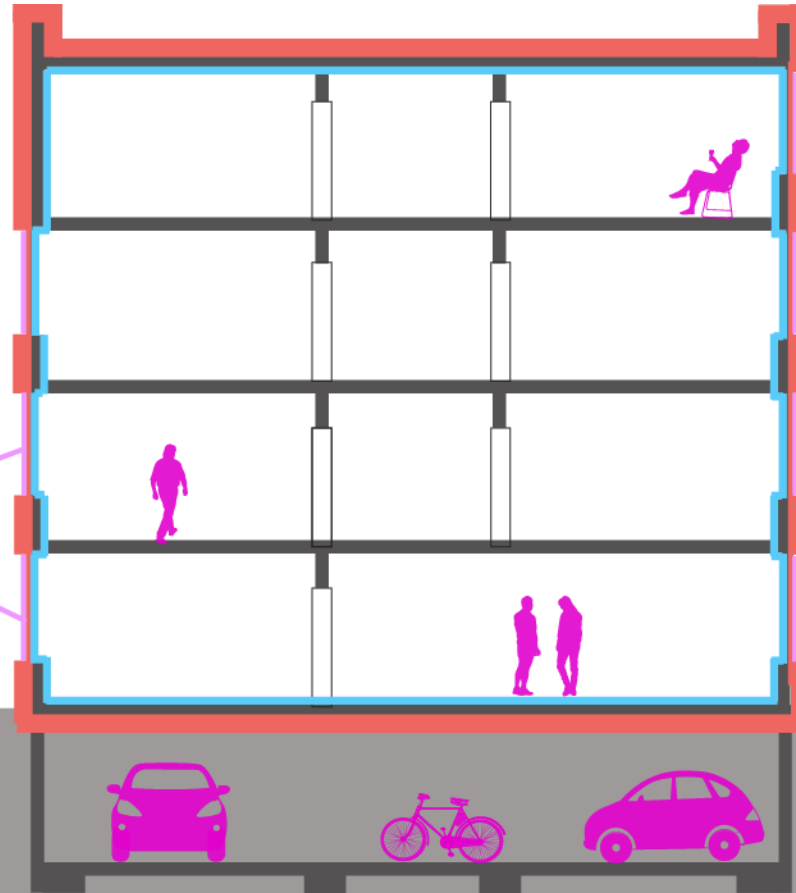
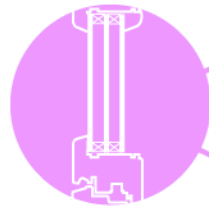
The Pencil Rule



Source: PHI, Author: JS

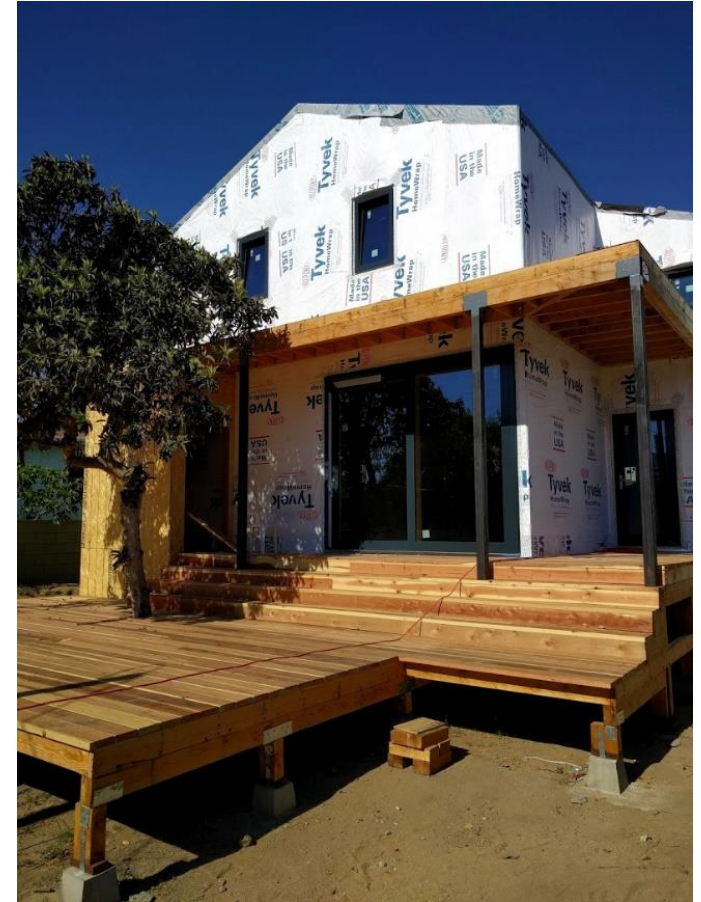
3. INTEGRATED WINDOWS & DOORS

- Performance criteria are climate dependent



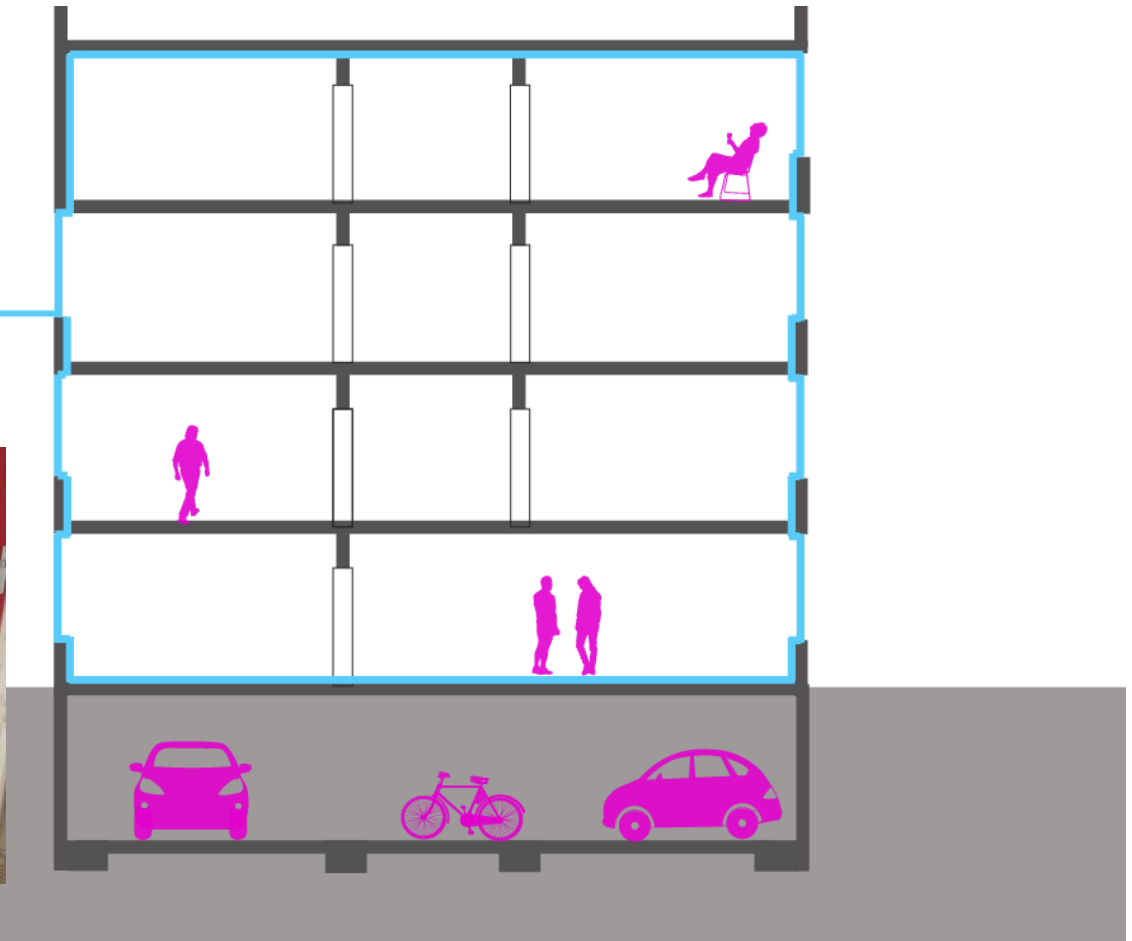
Must maintain enclosure continuity of airtightness and insulation.

WINDOWS & SHADING



4. CONTINUOUS AIRTIGHTNESS

Tested airtightness
limit of 0.6 ACH50



Airtightness is a driving force of performance.

AIRTIGHTNESS



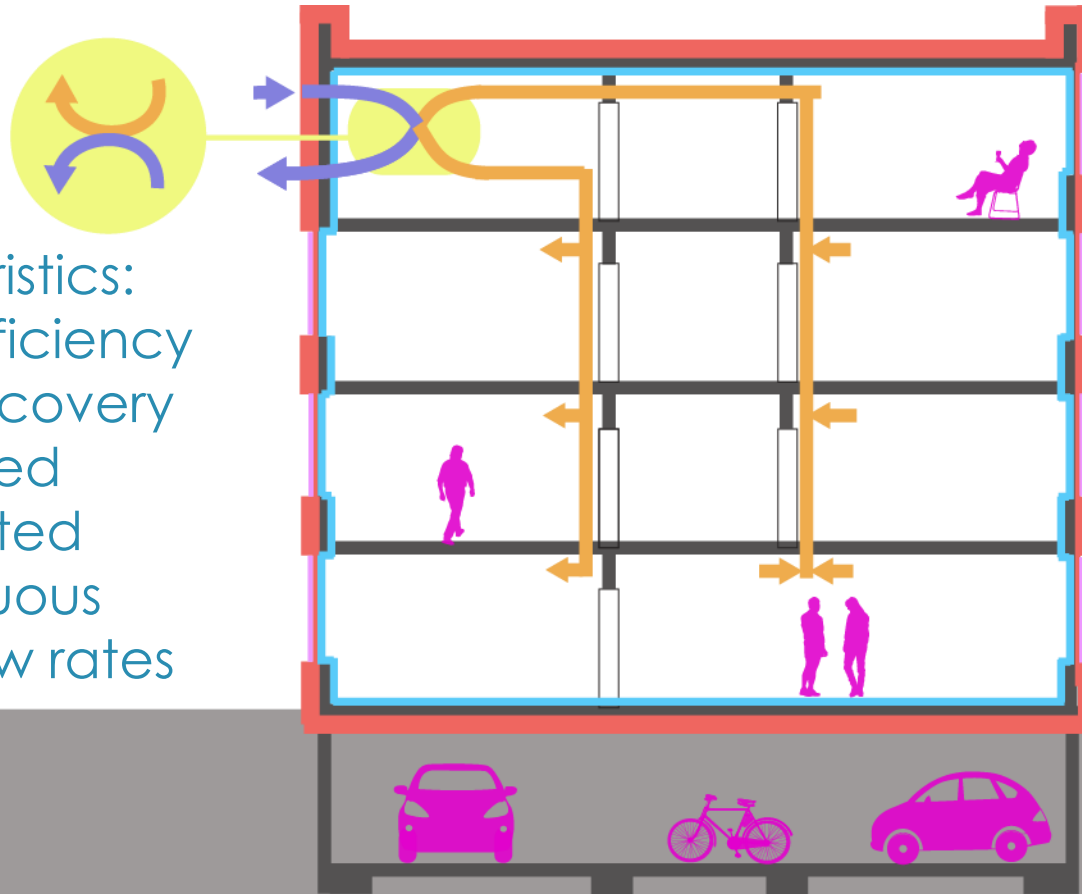
5"

PHI REQUIREMENT
FOR PERLITA HOUSE

16"

TYPICAL NEW
CONSTRUCTION (x10)

5. VENTILATION



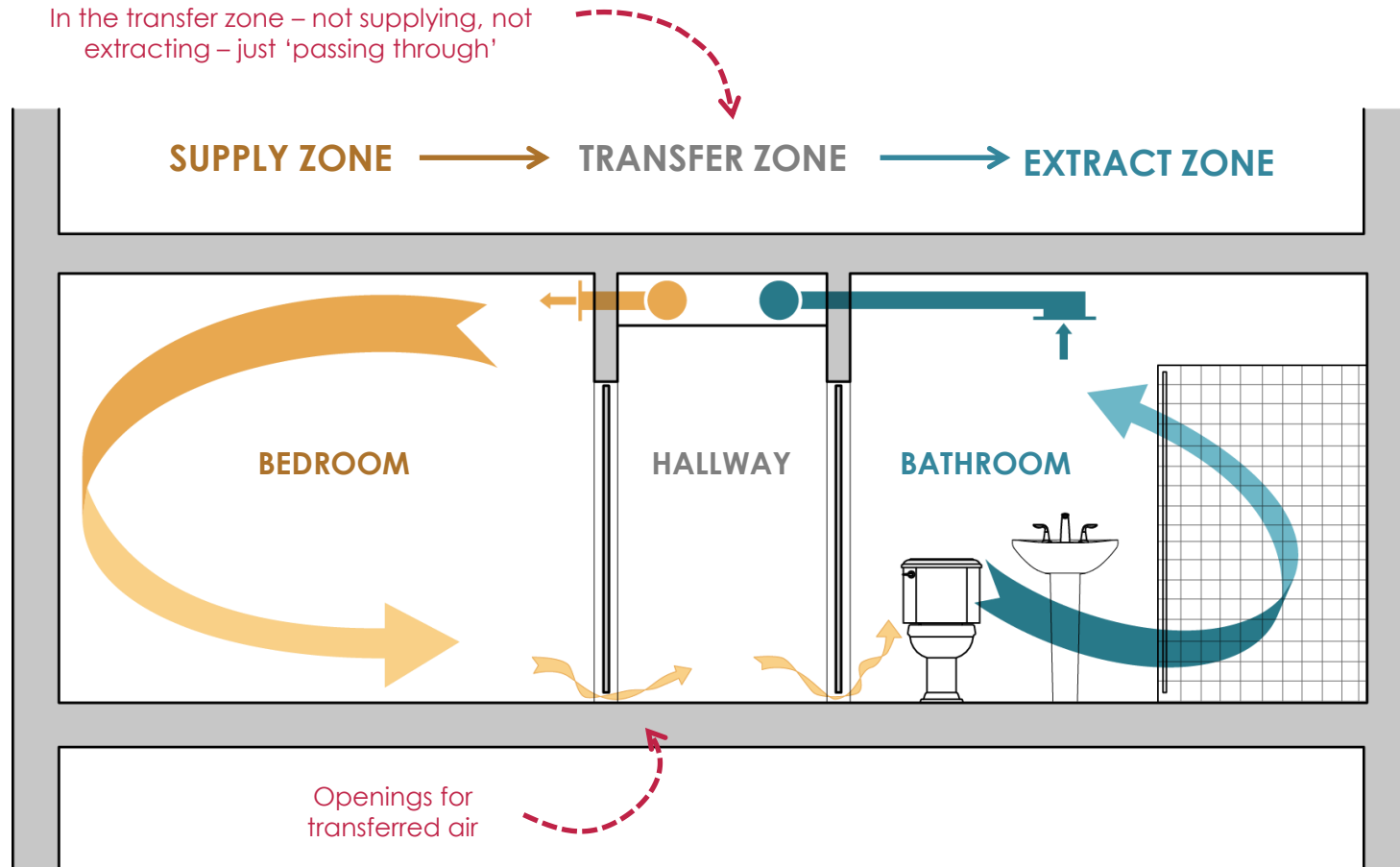
Characteristics:

- High efficiency heat recovery
- Balanced
- Distributed
- Continuous
- Low flow rates

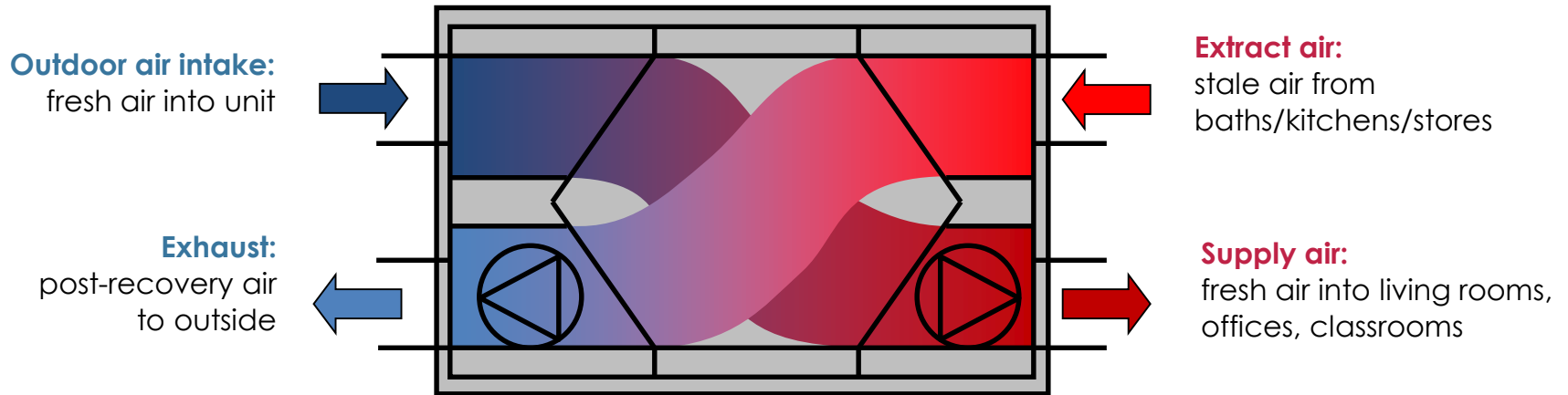
Controlled high indoor air quality possible using very little energy.

BALANCED VENTILATION: SUPPLY & EXTRACT ZONES

The distribution of ventilation (fresh air supply and stale air extraction) should **use as little ductwork as possible** but still provide air flow through the entire building:



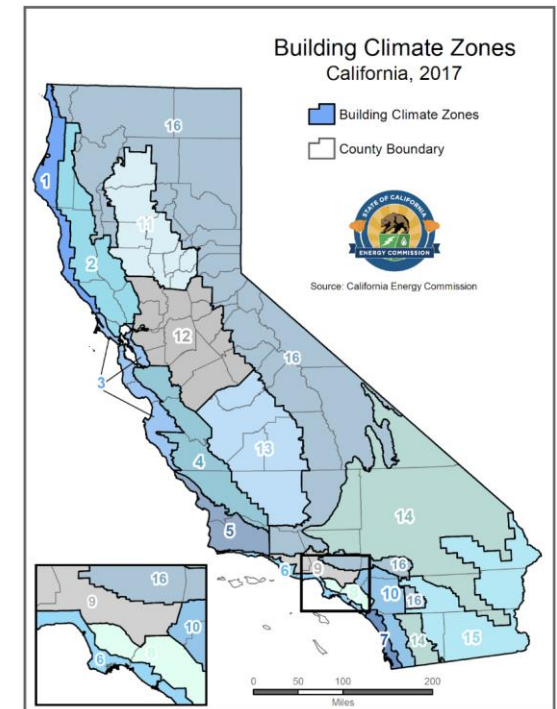
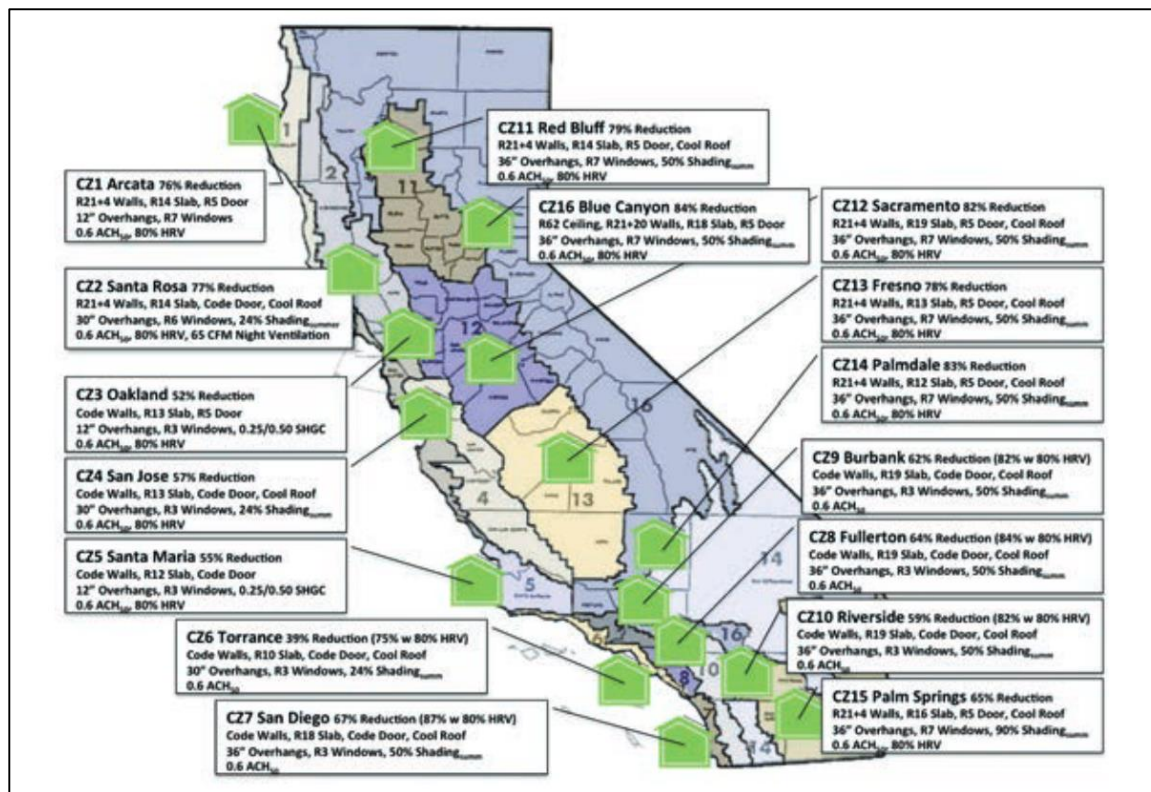
H/ERV



It is happening in California

Why a Passive House Reach Code?

2013 Study found **PH delivers 39% to 83% reduction** in heating & cooling in all sixteen California Climate Zones



Source: 2013 Study by PHCA Member, Graham Irwin, Essential Habitat.

PHPP is now ASHRAE 140 verified

ASHRAE 140 Class II test cases of PHPP_9.6 for Heating and Cooling combined

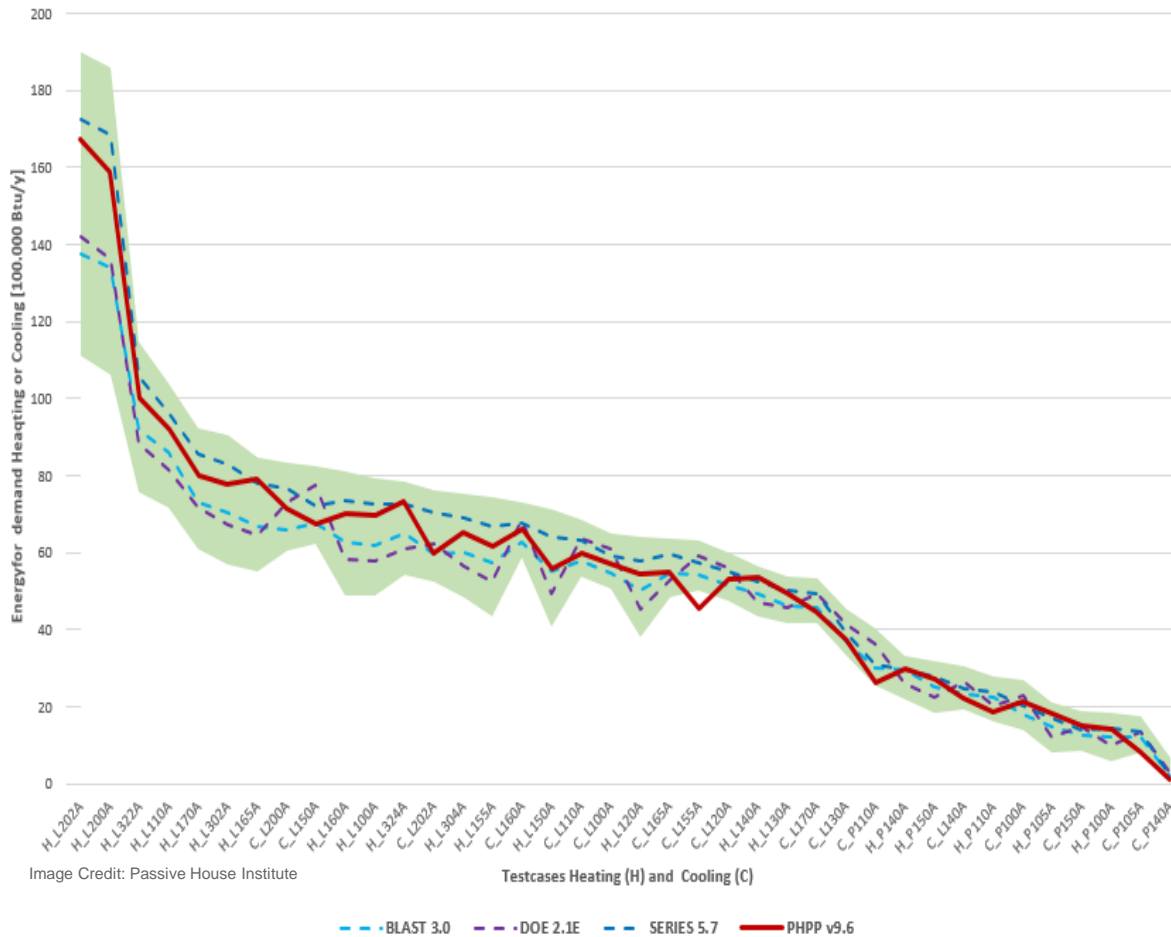


Image Credit: Passive House Institute

Results of PHPP version 9.6 compared to the reference tools and the confidence range in green, arranged according to magnitude of the results



Why a Passive House Reach Code?



California's 2019 Reach Code:
A Passive House Pathway

December 18, 2018



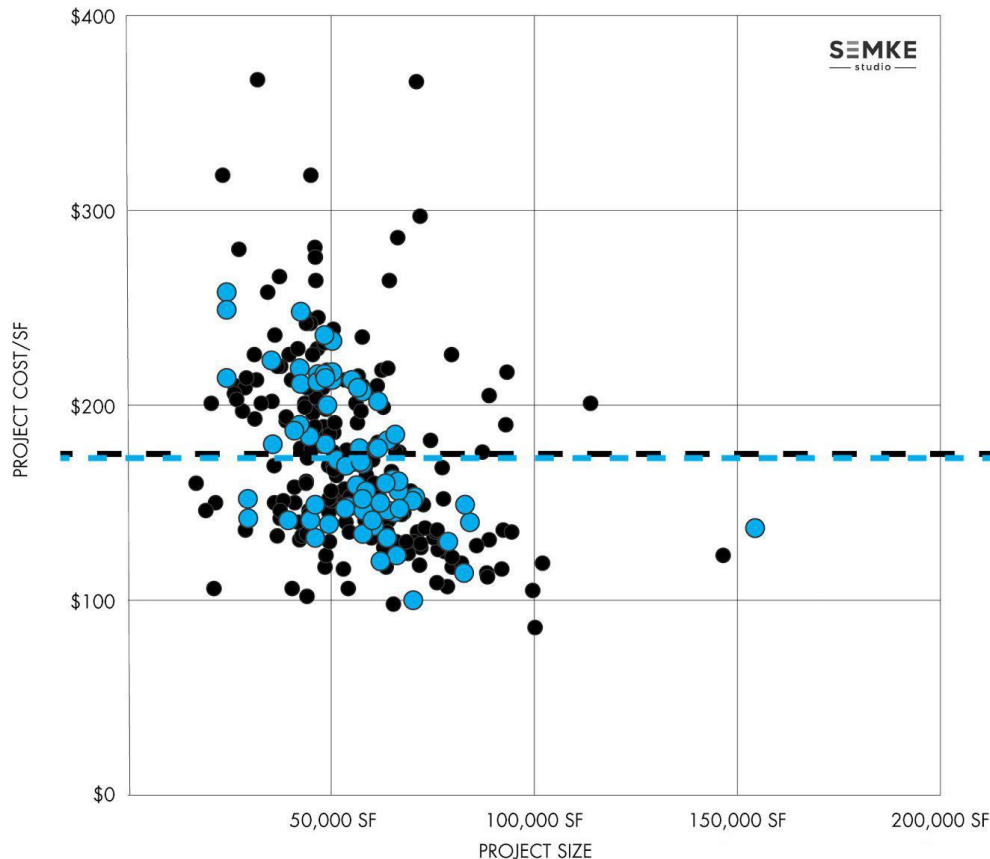
- ❑ Requested by City of Santa Monica
- ❑ PHCA Strategic Plan led to focus on:
Low-rise Multifamily

Source:

http://www.passivehousecal.org/sites/default/files/media/PHCA%202019%20Reach%20Code%20Report_FINAL.pdf

Why a PH Multifamily Reach Code?

268 Proposals to Pennsylvania Housing Finance Agency (2015-2018)



DATA SOURCE: Pennsylvania Housing Finance Agency

- ❑ Bigger buildings are more cost effective
- ❑ Larger buildings are easier to air-seal
- ❑ Larger buildings need less insulation (lower embodied energy)
- ❑ Multifamily buildings support transit & lower vehicle emissions
- ❑ Multifamily buildings address our housing crisis
- ❑ Other regions are having GREAT SUCCESS with MF.

Results are VERY EXCITING!



Title 24, Parts 6 and 11
Local Energy Efficiency Ordinances

**2019 Cost-effectiveness Study:
Low-Rise Multifamily Residential New
Construction Addendum –
Passive House Equivalency Analysis for
2019 Energy Efficiency Ordinances**

Prepared for:
Kelly Cunningham
Codes and Standards Program
Pacific Gas and Electric Company

Prepared by:
Frontier Energy, Inc.
Misti Bruceri & Associates, LLC

“In almost all cases, the EDR Margins achieved by the Passive House designs exceed the EDR Margin targets, and **in most cases, the Passive House EDR Margin is significantly higher** than the target EDR Margins defined in the report.”

CBECC-Res vs PHPP output differences:

- Infiltration
- Heat Recovery Ventilation
- Duct Leakage assessment
- Attic Design

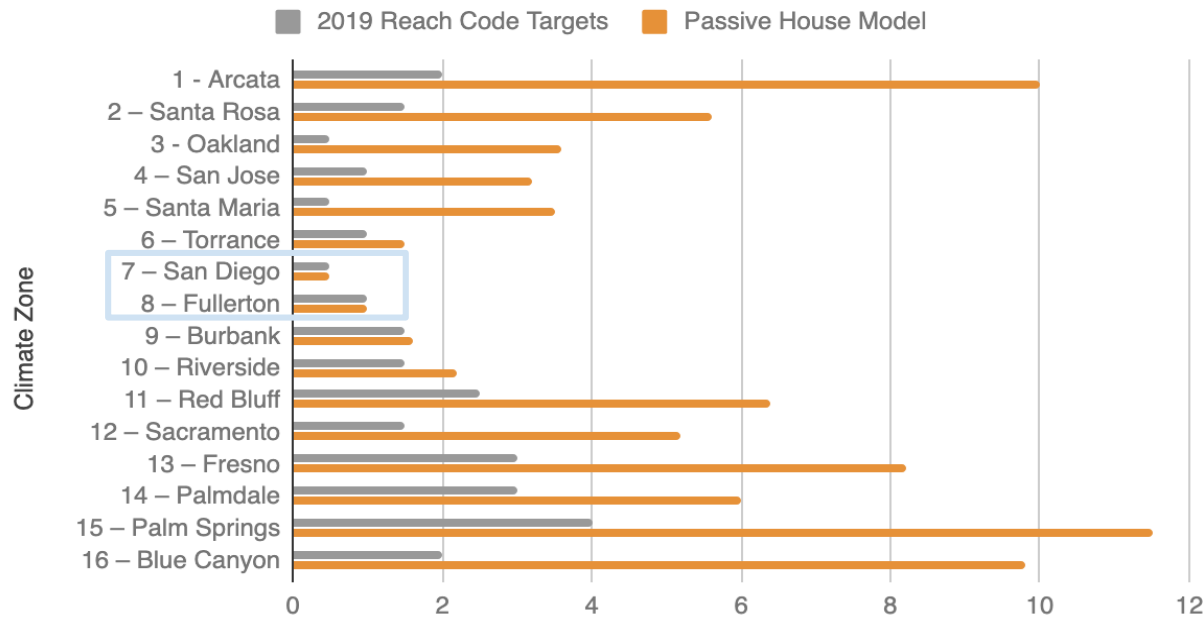
Results are VERY EXCITING!

Mixed Fuel EDR Margin			
Climate Zone	2019 Reach Code Targets	Passive House Model	% Improvement
1 - Arcata	2	10	400%
2 - Santa Rosa	1.5	5.6	273%
3 - Oakland	0.5	3.6	620%
4 - San Jose	1	3.2	220%
5 - Santa Maria	0.5	3.5	600%
6 - Torrance	1	1.5	50%
7 - San Diego	0.5	0.5	0%
8 - Fullerton	1	1	0%
9 - Burbank	1.5	1.6	7%
10 - Riverside	1.5	2.2	47%
11 - Red Bluff	2.5	6.4	156%
12 - Sacramento	1.5	5.2	247%
13 - Fresno	3	8.2	173%
14 - Palmdale	3	6	100%
15 - Palm Springs	4	11.5	188%
16 - Blue Canyon	2	9.8	390%

All-Electric EDR Margin			
	2019 Reach Code Targets	Passive House Model	% Improvement
1 - Arcata	3	11.1	270%
2 - Santa Rosa	1.5	7.4	393%
3 - Oakland	0.00	3.6	NA
4 - San Jose	1	4	300%
5 - Santa Maria	0.5	4	700%
6 - Torrance	1	2.8	180%
7 - San Diego	0.5	1.3	160%
8 - Fullerton	1	1.4	40%
9 - Burbank	1.5	2.6	73%
10 - Riverside	1.5	3.5	133%
11 - Red Bluff	3.5	8.2	134%
12 - Sacramento	2.5	6.3	152%
13 - Fresno	3	8.8	193%
14 - Palmdale	3.5	7.1	103%
15 - Palm Springs	4	11.8	195%
16 - Blue Canyon	3	13.8	360%

Mixed Fuel RESULTS:

Mixed Fuel Passive House Reach Code EDR Margin

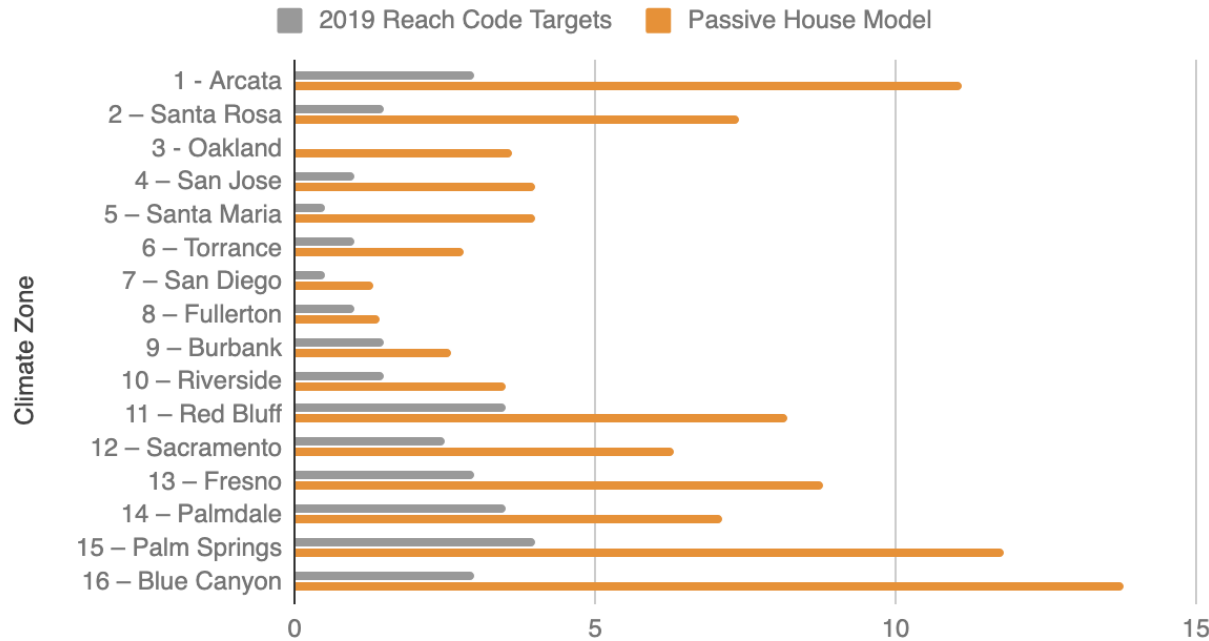


*Only CZ's 7 & 8 do not exceed the 2019 EDR requirements

Mixed Fuel EDR Margin			% Improvement
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All-Electric RESULTS:

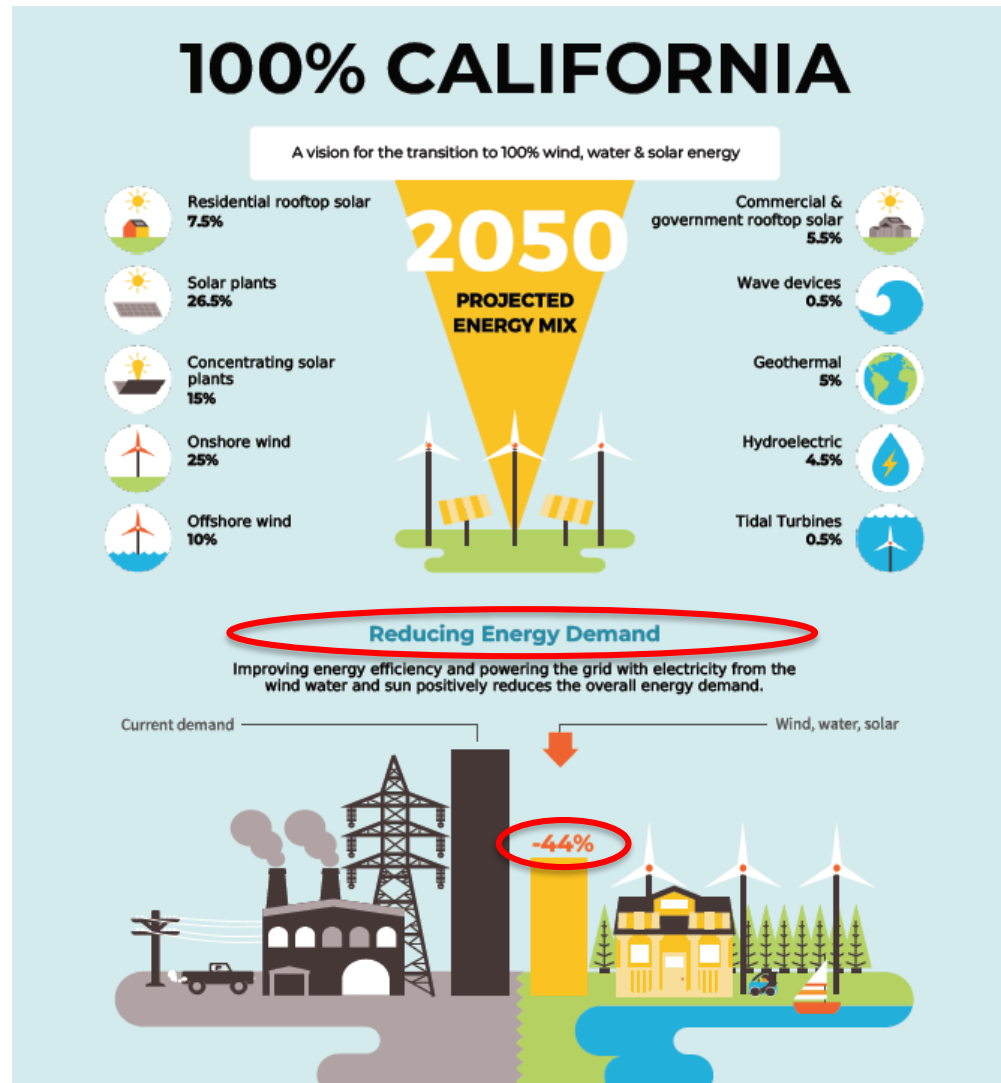
All-Electric Passive House Reach Code EDR Margin



**Supports electrification -
and ADDS THE MISSING EFFICIENCY!**

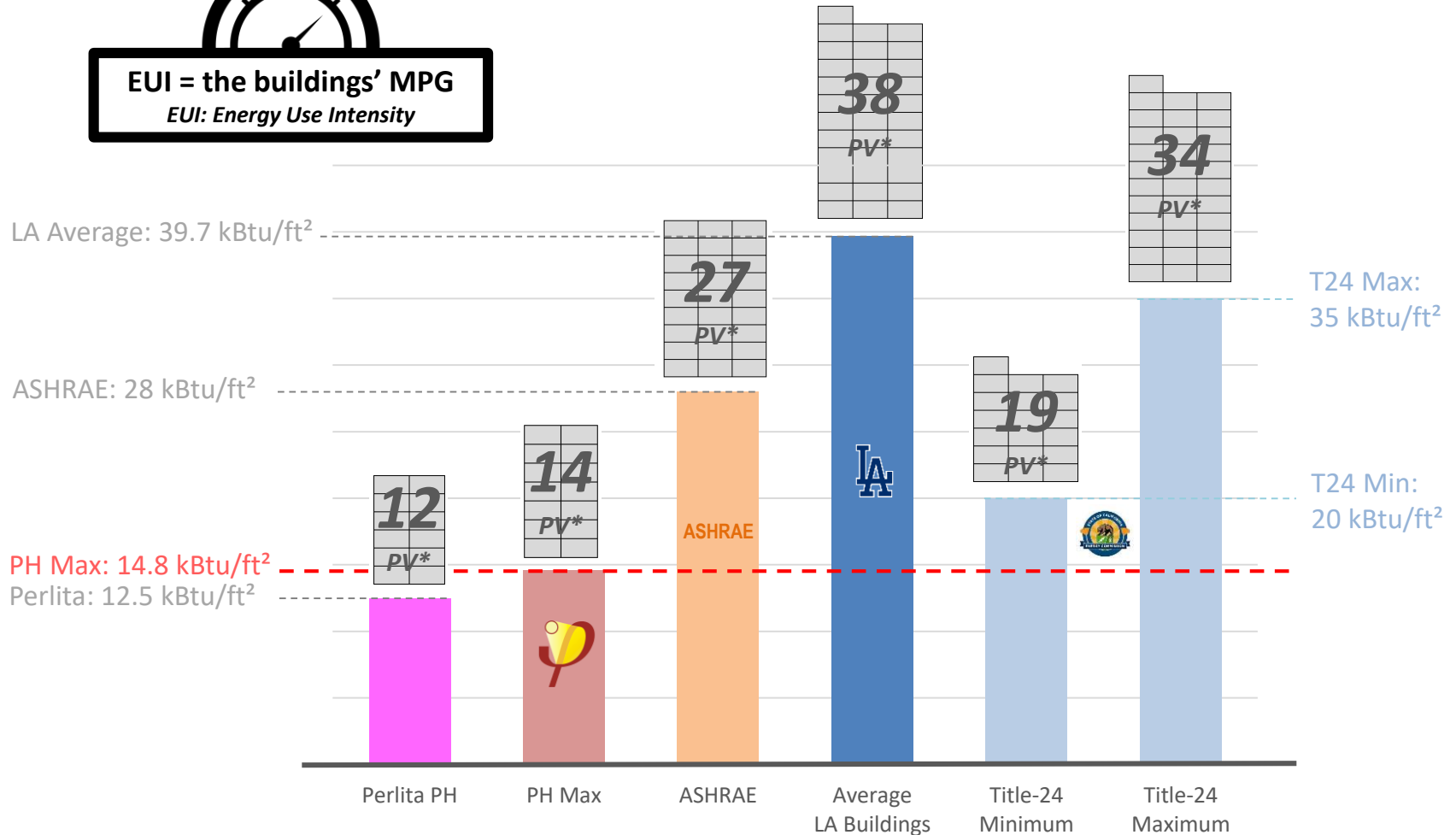
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4 - San Jose	1	4	300%
5 - Santa Maria	0.5	4	700%
6 - Torrance	1	2.8	180%
7 - San Diego	0.5	1.3	160%
8 - Fullerton	1	1.4	40%
9 - Burbank	1.5	2.6	73%
10 - Riverside	1.5	3.5	133%
11 - Red Bluff	3.5	8.2	134%
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14 - Palmdale	3.5	7.1	103%
15 - Palm Springs	4	11.8	195%
16 - Blue Canyon	3	13.8	360%

Why support a PH Reach Code?



Why numbers matter

EUI = the buildings' MPG
EUI: Energy Use Intensity



* Number of Photovoltaic panels for the Perlita House to reach Net Zero Energy

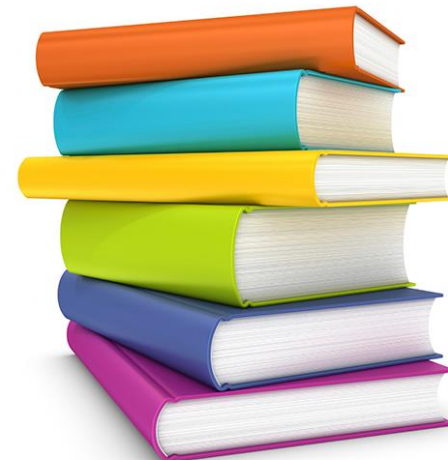
PROVIDE CARROTS (CITIES):

- Increased FAR for projects that target PH
- Increased HEIGHT allowances for projects that target PH
- UPZONING for projects that target PH
- Initiate a City-Owned PH Pilot project
- Promote PH on your city website
- Train City Staff and Workforce
- Support & host PHCA trainings & events



PROVIDE EDUCATION (UTILITIES):

- Support GRANT subsidies for Passive House courses
- Provide incentives for Passive House pilot projects (\$\$\$ & promotion)
- Support PHCA & NAPHN events



Example Policies: <https://drive.google.com/file/d/1x49Xmey6qaqfG-XDhzvq4TfbdTqhvi0a/view>

Resources:

CITY OF VANCOUVER Jobs and careers 3-1-1 Guides

Green Vancouver Your government About Vancouver Parks, recreation, and culture Home, property, and development People and programs Streets and transportation Doing business

Find city information, services and more...

Home > Green Vancouver > Zero emissions buildings > Build a Passive House

- Green Vancouver**
- Greenest City Action Plan
 - Renewable City Action Plan
 - Zero emissions buildings
 - Build a Passive House**
 - Building catalyst tools
 - Multi-family building energy resources and programs
 - Zero Waste 2040
 - Climate Change Adaptation Strategy
 - Climate Emergency Response
 - Neighbourhood Energy Strategy
 - How we are greening City operations



Build a Passive House

How to get Passive House certification

Passive House certification is a quality assurance process determines whether a project meets all of the requirements of the Passive House standard.

It confirms that the building has been designed to achieve a level of occupant comfort and energy performance.

The primary criteria for achieving Passive House certification are:

- **Space Heat Demand:** Maximum 15 kWh/m²a or heating maximum 10 W/m²
- **Air Tightness:** Maximum 0.6 ACH @ 50 Pa (pressurizing, depressurizing)
- **Total Primary Energy Renewable (PER):** Maximum 60 kWh/m²a

Learn more about the [Passive House standard](#) and [certification process](#).

NYC Housing Preservation & Development 311 Search all NYC.gov websites

NYC 繁體中文 Translate Text-Size

Housing Preservation & Development

About Renter Owner **Developer** Vendor Community Sec. 8 Search

Sustainability

Passive House

Share Print

About Passive House

Passive House is a high performance building standard developed by the Passive House Institute (PHI) originally in 1990 and by the Passive House Institute US (PHIUS) in 2007.

Buildings certified to Passive House standards reliably provide reduction in energy needed for heating and cooling of up to 90%, and up to 75% reduction in overall energy use, compared to existing buildings. It focuses on passive measures and building components such as insulation, airtightness and heat recovery to provide tenants with superior quality residences, while increasing long term viability for building owners through lower utility bills.

Residents benefit from great indoor air quality, comfortable and even temperatures, significantly reduced energy bills and acoustically superior homes from reduced noise attenuation from neighbors and street noise.

HPD Passive House Projects

HPD has completed a number of Passive House projects and have many others under construction or in development. See some of our built projects below.

Knickerbocker Commons

Beach Green Dunes

HANAC Corona Senior Residence

Residential New Homes and Renovations Initiative

D.P.U. 18-110 – D.P.U. 18-119
Three-Year Plan 2019-2021
October 31, 2018
Exhibit 1
Page 44 of 209

Incentives	Passive House Incentives	
	Recipient	Details
Energy Subsidy	Owner	Cost-share of Warme Und Feuchte Instationar or Passive House Planning Package modeling costs or early feasibility study
Team Incentive	Architect, Design Team	\$/kWh and \$/therm incentives for projects achieving precertification and certification (if applicable)
Charrette	Architect, Design Team	Sustainability charrette incentive in either Programming and Schematic or Design Development design phases, directed to design team lead
Energy Subsidy	Owner	Adder per multi-family unit for achieving PHIUS or PHI certification
Energy Incentive*	Owner	\$/kWh and \$/therm incentives for savings where projects are performing more efficient than the User Defined Reference Home for the residential portion and Mass Save baseline for the commercial spaces.

actively working to include infiltration incentives for High Rise buildings to better quantify performance savings. The PAs are committed to changing the process by which savings are claimed to be a more whole building performance based approach for the offer. The PAs and DOER will work expeditiously with EM&V to pursue this change using Passive House certification modeling utility savings.

Coordination

A working group of residential and commercial sector experts from each Program Administrator collaborate to oversee the Low-Rise and Master-Metered/High-Rise station strategies with the statewide lead vendor. The lead vendor provides the direct field station.

The lead vendor is responsible for developing and deploying training, education, and outreach efforts, as well as tracking and reporting program activity to each Program Administrator. The lead vendor has principal responsibility for recruiting and enrolling projects. Many Program Administrators maintain additional account representatives and field personnel that also help support project recruitment and maintain relationships with the target market and allies. HERS raters, as noted above, play a key role in the Low-Rise path for recruiting and enrolling projects.

MassSave Program:

44 <http://ma-eeac.org/wordpress/wp-content/uploads/Exh.-1-Final-Plan-10-31-18-With-Appendices-no-bulk.pdf>



City of Vancouver General Info:

<https://vancouver.ca/green-vancouver/build-a-passive-house.aspx>

NYC General Info:

<https://www1.nyc.gov/site/hpd/development/passive-house.page>

Contact us:
info@passivehousecal.org

Get Trained

Architects, Engineers, Consultants, Owners,
Contractors, Real Estate Brokers, Policymakers...



Certified Passive House Designer/Consultant

> Los Angeles – January 27-31, 2020

> Los Angeles – May 30, 31 & June 5-7, 2020

www.passivehousecal.org