



EMPOWERING PEOPLE

To make healthier and more sustainable choices in the renovation and construction of the places we live

Over 30,000 educated

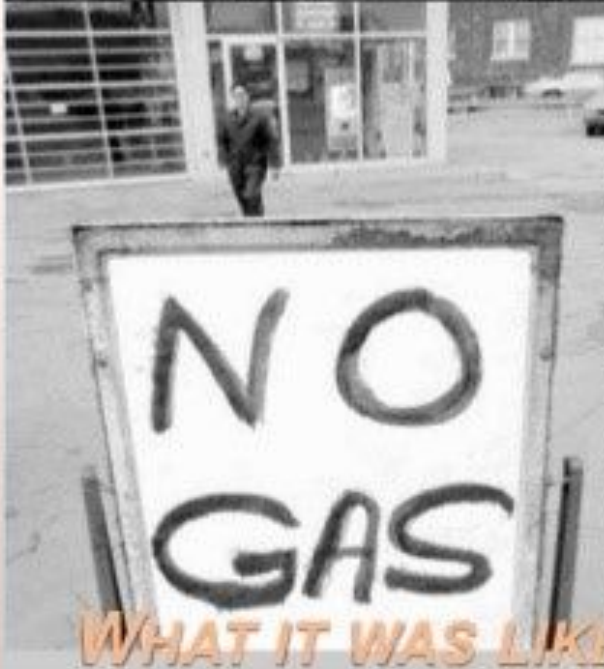
13,000 Greener Homes

501C3 Non Profit

Greenhomeinstitute.org

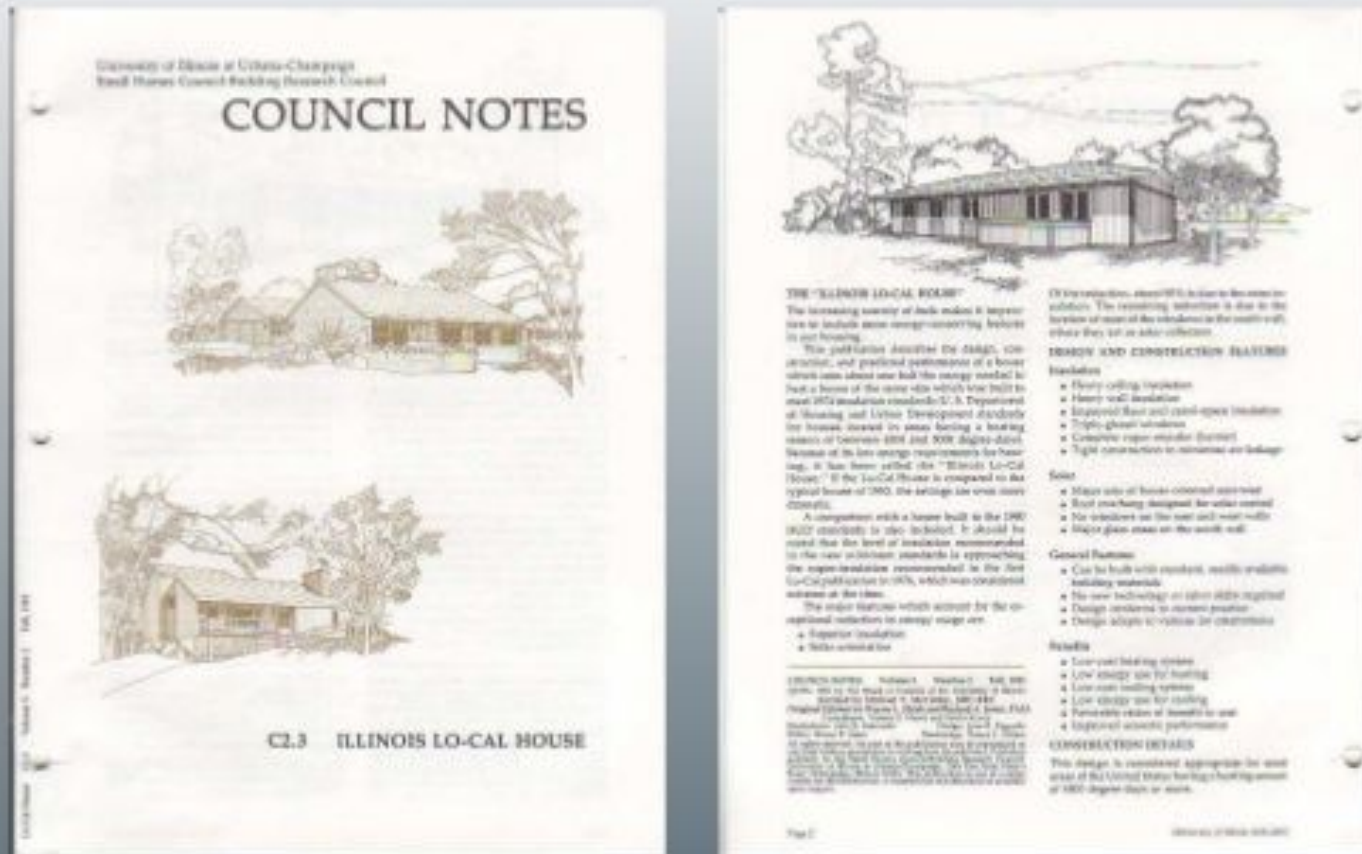


Passive House Institute US



WHAT IT WAS LIKE

Conservation = Resource



Source: The Small Homes Council at the University of Illinois

Illinois Lo-Cal House, 1974



The first Passive House: Interview with Dr. Wolfgang Feist



*Passive House
Institute*





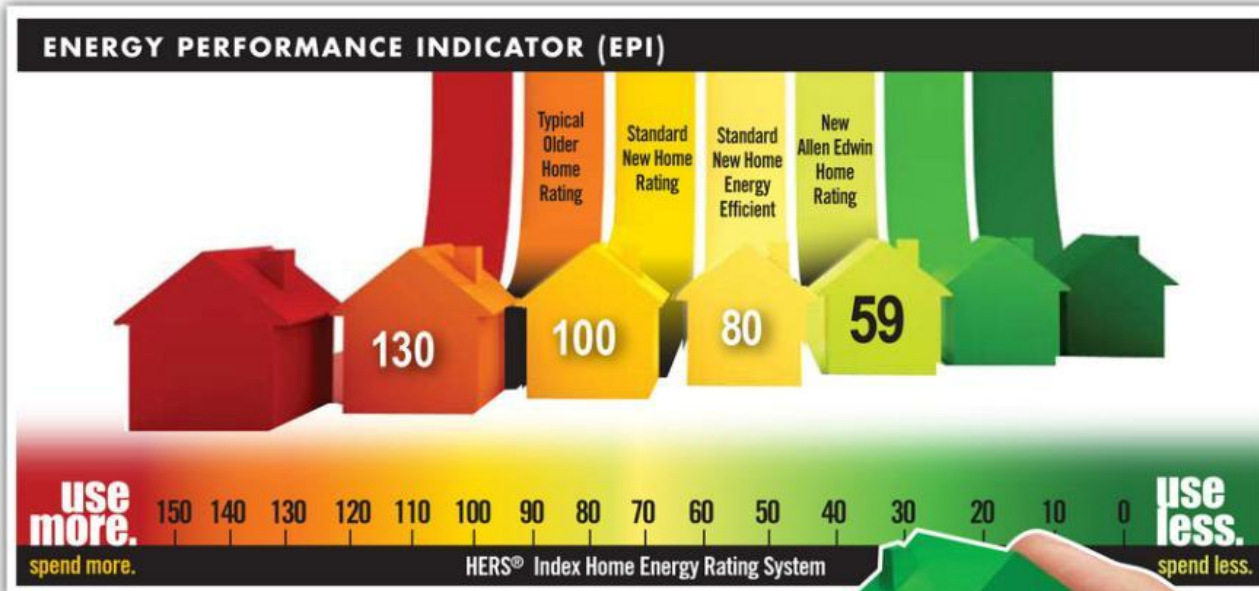
Passive House Institute US

Program Building





HERSindex.com



**The EPA recently announced new standards for ENERGY STAR Qualified Homes. The increased standards, known as version 3.0, are effective with certificates of occupancy received on or after January 1, 2012. The new standards require the home to measure 41% more energy efficient than the previous standards. Allen Edwin Homes is committed to building ENERGY STAR Qualified Homes - because helping the environment, helps us all.*

ANNUAL ENERGY COST COMPARISON				
MODEL	ALLEN EDWIN Energy Star Home	NEW CONSTRUCTION Energy Efficient	NEW CONSTRUCTION TO CODE	1972 OR OLDER HOME
ELEMENTS 2100	59 HERS - \$2111	80 HERS - \$2811	100 HERS - \$3477	130 HERS - \$4476

ESTIMATED MONTHLY **SAVINGS***



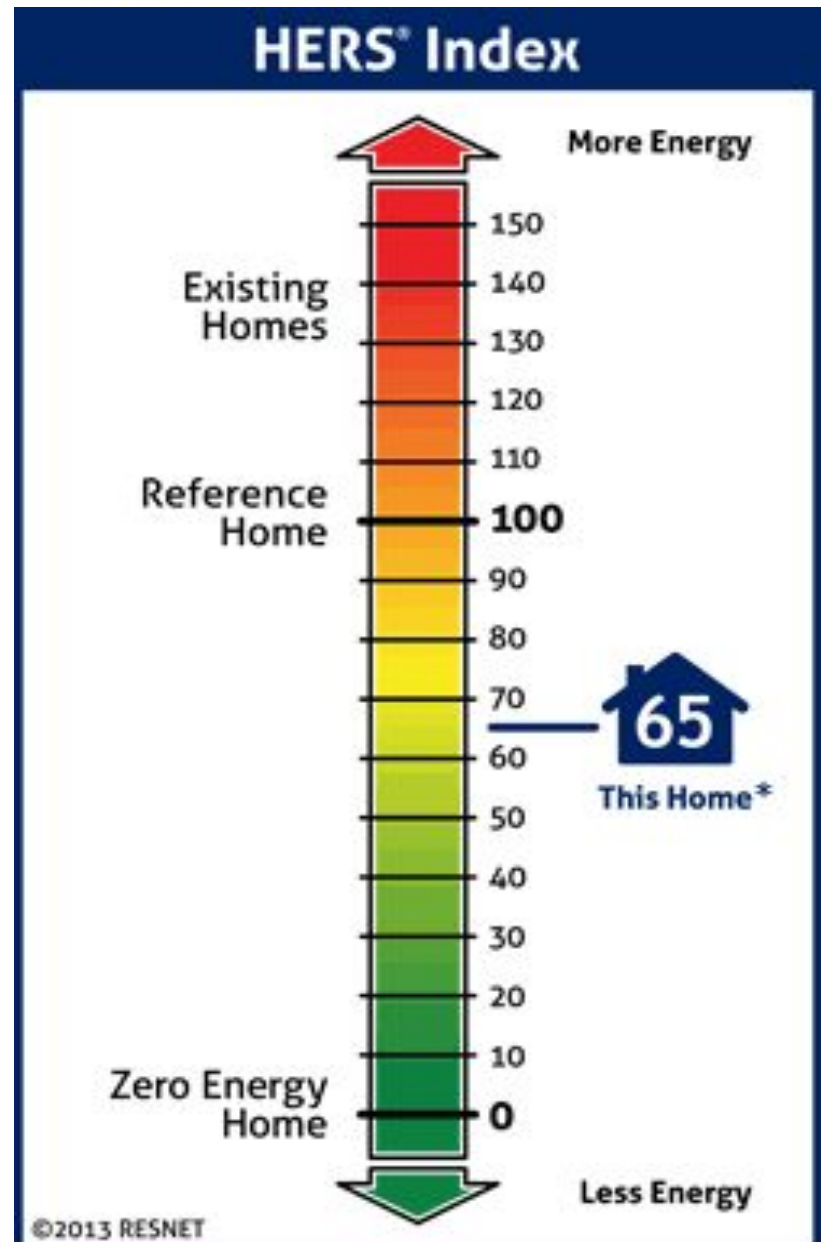
Home Energy Rating System (HERS)

Performance Testing:

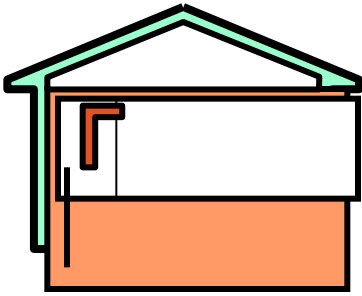
- Heating and cooling
- Water heating
- Lighting
- Appliances
- Building envelope



HERSindex.com







ENERGY STAR VERSION 3

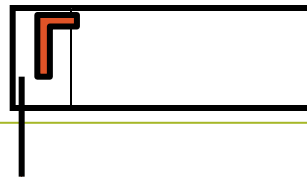
Thermal Enclosure System:

- Air Leakage
- Insulation R-Value
- Insulation Installation
- Air Barriers
- Thermal Bridging
- High-Perf. Windows



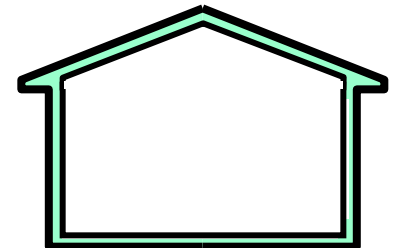
HVAC Quality Installation System:

- Efficient Equipment
- Right-Sizing
- Air Distribution
- Refrigerant Charge
- Duct Installation
- Pressure Balancing
- Ventilation
- Filtration



Water Management System:

- Roof Membranes
- Flashing
- WRB's
- Fabric Filters
- Capillary Breaks
- Drainage Layer





What distinguishes new homes with the Indoor airPLUS label?

With Indoor airPLUS, EPA offers a way for builders to distinguish themselves by building homes with professional best practices, including the following design and construction features:

Moisture Control: Build in added protection from mold and other moisture problems with water managed roofs, walls, and foundations. Features include continuous drainage planes, proper flashing and air sealing, damp-proof foundation walls, capillary breaks, drain tile, and proper grading.

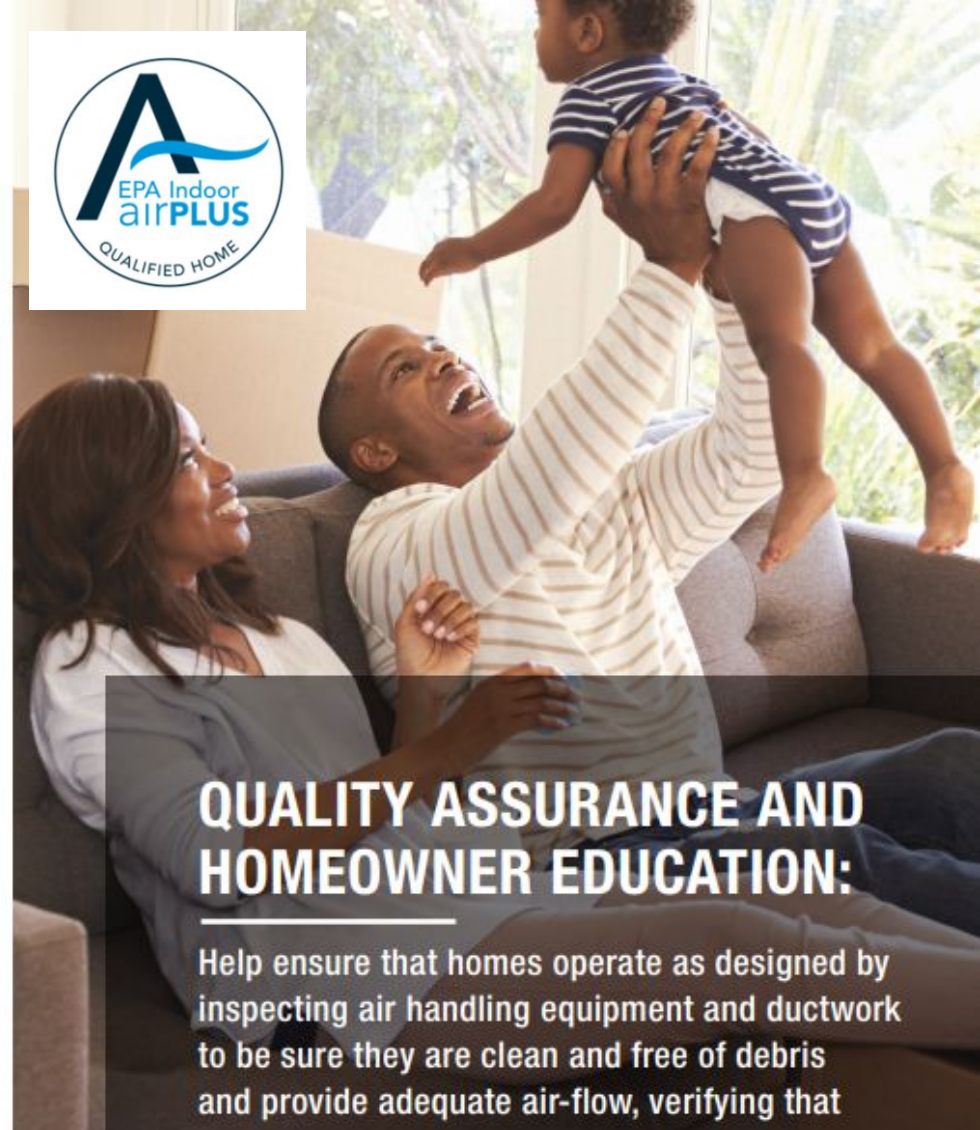
Radon Control: Provide radon-resistant construction in high radon potential areas, including gravel and plastic sheeting below slabs, fully sealed and caulked foundation penetrations, plastic vent pipe running from below slab through the roof, and an attic receptacle for easily adding an electric powered fan to the vent pipe if needed.

Pest Management: Provide a first-line defense against pest problems by fully sealing, caulking, or screening likely pest entry points. When these physical barriers are combined with proper pest management techniques, pesticide use may be reduced.

Heating, Ventilating, and Air-Conditioning (HVAC): Improve indoor air quality with best practice design and installation of ducts and equipment to minimize condensation problems, whole-house and spot ventilation to help dilute and exhaust indoor pollutants, and improved air filtration to remove airborne particulates.

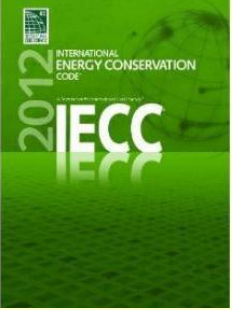
Combustion Venting: Protect residents from potential exposure to combustion gases by installing direct-vented or power-vented gas- and oil-fired equipment, properly vented fireplaces, garages fully sealed from living spaces, and carbon monoxide alarms in each sleeping area.

Building Materials: Reduce sources of pollutants by selecting and installing materials to minimize risk of moisture damage, specifying materials with reduced



QUALITY ASSURANCE AND HOMEOWNER EDUCATION:

Help ensure that homes operate as designed by inspecting air handling equipment and ductwork to be sure they are clean and free of debris and provide adequate air-flow, verifying that



Homes to the Power of **ZERO**



ZERO
ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

What is the DOE Zero Energy Ready Home™ Label?

It is a Symbol of Excellence for energy savings, comfort, health, quality, and durability met by a select group of leading builders meeting U.S. Department of Energy Guidelines.

A Symbol of Excellence

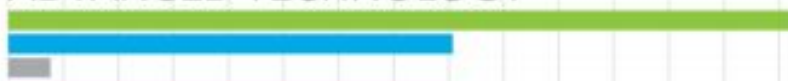
HEALTHFUL ENVIRONMENT



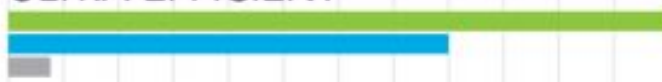
COMFORT PLUS



ADVANCED TECHNOLOGY



ULTRA EFFICIENT



QUALITY BUILT



DURABILITY



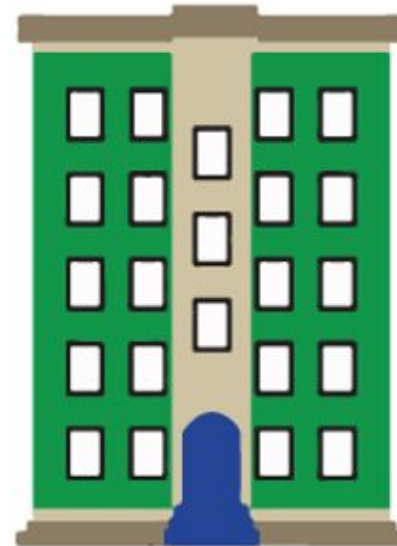
Program Scope & Applicable Building Types



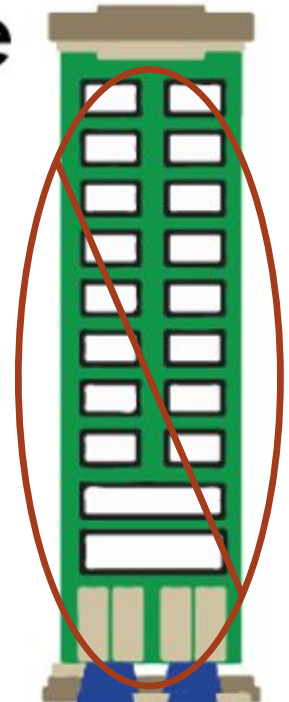
Single Family Homes



Low-Rise Multifamily



Mid-Rise Multifamily



Mixed Use & Highrise



Single-Family Production



Cut Rehab



Additions, Remodels & Weatherization Projects

DOE Zero Energy Ready Home PV-Ready Checklist



1. Location, based on zip code has at least 5 kWh/m²/day average daily solar radiation based on annual solar insolation using PVWatts online tool:
http://gisatnrel.nrel.gov/PVWatts_Viewer/index.html **AND**;
2. Location does not have significant natural shading (e.g., trees, tall buildings on the south-facing roof, **AND**;
3. Home as designed has adequate free roof area within +/-45° of true south as noted in the table below.

<u>Conditioned Floor Area of the House (sq. ft.)</u>	Minimum Roof Area within +/- 45° of True South for PV-Ready Checklist to Apply (ft ²)
≤ 2000	110
≤ 4000	220
≤ 6000	330
> 6000	440

Kalamazoo Valley Habitat for Humanity

The Glendale Model
Kalamazoo, MI



Kalamazoo Valley Habitat for Humanity built this 1,120-ft² home in Kalamazoo, Michigan, to the performance criteria of the DOE Zero Energy Ready Home (ZERH) program. The home is equipped with an ENERGY STAR-rated refrigerator. It also meets the EPA Indoor airPLUS requirements by using wood products, primer, paint, cabinets, and flooring that limit the release of air contaminants.





1/13

AquaZephyr, LLC, built this 22,600-square-foot, 15-unit multifamily building in Ithaca, New York, to the performance criteria of the U.S. Department of Energy Zero Energy Ready Home (ZERH) program. The angular decks and entry area were designed to increase the amount of southern exposure for passive solar gain.



HERS 26

This home's score without PV












\$50

Average Monthly Energy Bill

Calculated

Program Building



							Source Zero Renewable Energy System
						Balanced Ventilation HRV/ERV	Balanced Ventilation HRV/ERV
					SOLAR READY Depends on climate	SOLAR READY ALWAYS	SOLAR READY ALWAYS
					Eff. Comps. & H2O Distrib	Eff. Comps. & H2O Distrib	Eff. Comps. & H2O Distrib
					 EPA Indoor airPLUS	 EPA Indoor airPLUS	 EPA Indoor airPLUS
					Ducts in Condit. Space	Ducts in Condit. Space	Ducts in Condit. Space
		HVAC QI w/WHV	HVAC QI w/WHV	HVAC QI w/WHV	HVAC QI w/WHV	Micro-load HVAC QI	Micro-load HVAC QI
		Water Management	Water Management	Water Management	Water Management	Water Management	Water Management
		Independent Verification	Independent Verification	Independent Verification	Independent Verification	Independent Verification	Independent Verification
IECC 2009 Enclosure	IECC 2012 Enclosure	IECC 2009 Enclosure	IECC 2012 Enclosure	IECC 2012/15 Encl./ES Win.	IECC 2012/15 Encl./ES Win.	Ultra-Efficient Enclosure	Ultra-Efficient Enclosure
HERS 85-90	HERS 70-80	HERS 65-75	HERS 55-65	HERS 48-55	HERS 48-55	HERS 35-45	HERS < 0
 IECC 2009	 IECC 2012	 ENERGY STAR v3	ENERGY STAR v3.1	 ZERH	 PHIUS+ PHIUS+	 PHIUS+ SourceZero	

<http://www.phius.org/phius-certification-for-buildings-products/phius-2015-project-certification/phius-certification-overview>



Passive House Institute US

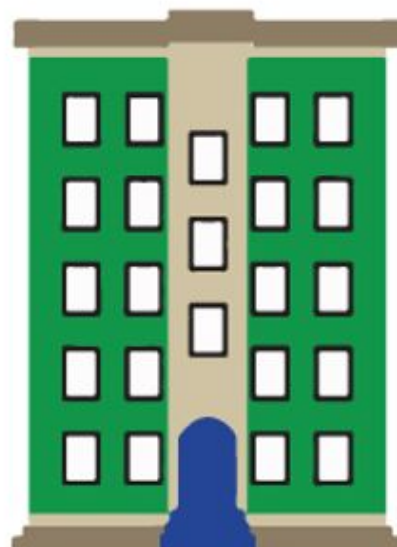
Program Scope & Applicable Building Types



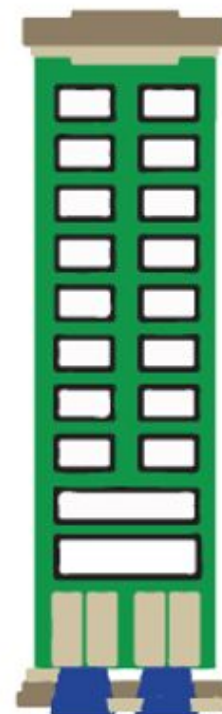
Single Family Homes



Low-Rise Multifamily



Mid-Rise Multifamily



Mixed Use & Highris



Single-Family Production



Cut Rehab



Additions, Remodels & Weatherization Projects



<http://www.phius.org/projects/1132?sort=%60BuildingFunctionTypes%60.%60BuildingFunctionType%60+ASC>

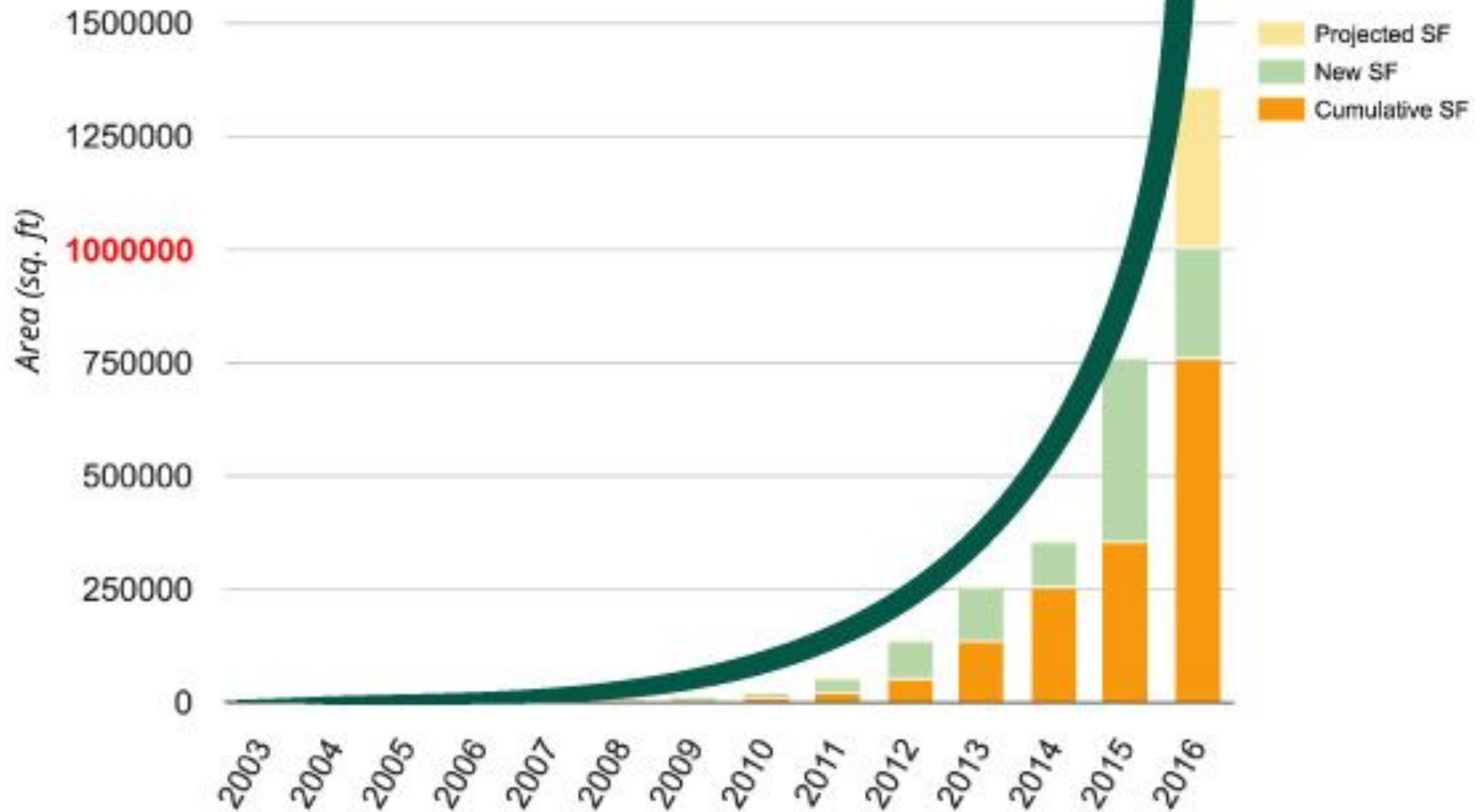
Largest Passive House Office Building in US to be Built in Chicago

Jun 14, 2018



http://www.valdostadailytimes.com/news/business/largest-passive-house-office-building-in-us-to-be-built/article_23345003-f742-52df-8b20-8d083e4fb8cb.html

PHIUS+ Certified and Pre-Certified Square Footage



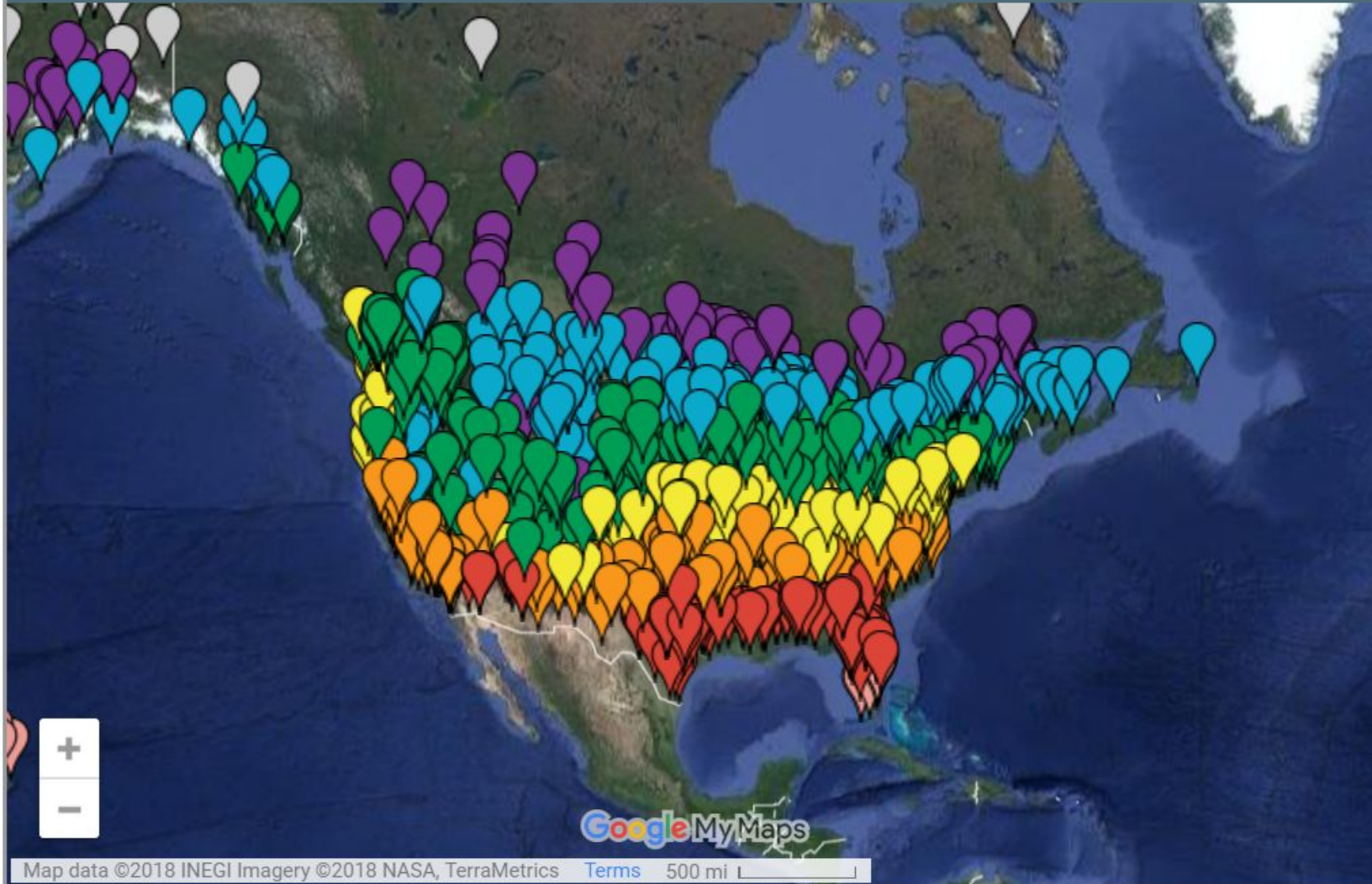
	Heating Demand/Load*	Cooling Demand/Load*	AIR-TIGHTNESS (cfm50/sf envelope)	Source Energy Demand	Renewable Generation for Source Zero
SINGLE FAMILY	1 - 16.8 kBTU/ft ² .yr 0 - 7.6 BTU/hr.ft ²	1 - 23.4 kBTU/ft ² .yr 1.3 - 9.5 BTU/hr.ft ²	0.05	6200 kWh/person.yr	>Source Energy Demand
COMMERCIAL				38 kBTU/ft ² .yr	>Source Energy Demand
MULTIFAMILY			0.08**	6200 kWh/person.yr / 38 kBTU/ft ² .yr	>Source Energy Demand
RETROFIT	As above, + allowance for existing thermal bridges	As above, + allowance for existing thermal bridges	0.05 / 0.08**		

*Maximum climate specific targets for each individual project

**Buildings with 5 stories+, non-combustible construction

Summary of other recommendations:

1. Window $U_{w\text{ install}}$ -values 0.4 – 0.08 BTU/hr. ft² °F (varies by climate)
2. Ventilation system with heat and/or moisture recovery with >53%-95% efficiency and efficient fan @ 0.27-2.23W/cfm (vary by climate)
3. Thermal bridge-free construction <0.006 BTU/hr. ft °F



Find your PHIUS+ 2015 Climate-Specific Performance Targets

Each point on the map lists the following criteria:

- City
- State/Province



WUFI@Passive V.3.0.0.0 C:\Users\T730\Desktop\2015 Pre-Conference WUFI Passive Static Workshop\WUFI Passive Files\Karpiak 150903 FINAL.mwp

File Input Options Database Help

Scope **Passive house verification** English/IP/Outer dimensions Assign data

Project

- Case 1: Karpiak
 - Localization/Climate: WILKES-BARRE SCRANTON INTL AP PA
 - Building
 - PH case: Passive house: Residential
 - Zone 1: Interior
 - Visualized components
 - Component 1: Slab
 - Component 2: Roof
 - Component 3: Walls
 - Component 4: Windows
 - Not visualized components

Localization Climate Primary energy/CO2factor

Selection User defined Browse

Name WILKES-BARRE SCRANTON INTL AP PA

Parameters	
Latitude [°]	41.333
Longitude [°]	-75.733
Altitude weather station [ft]	931.75853
Altitude building [ft]	
Daily temperature swing summer [°F]	19.62
Average wind speed [ft/s]	13.1234
Length of heating period [days/yr]	212
Ground	
Ground thermal conductivity [Btu/hr ft °F]	1.1556

Space conditioning target data Select from climate data

- Annual heating demand [kBtu/ft²/yr]
- Annual cooling demand [kBtu/ft²/yr]
- Peak heating load [Btu/hr ft²]
- Peak cooling load [Btu/hr ft²]

Data state/results Show warnings

Heating demand:	4.11 kBtu/ft²/yr		✓
Cooling demand:	1.55 kBtu/ft²/yr		✓
Heating load:	3.27 Btu/hr ft²		✓
Cooling load:	2.27 Btu/hr ft²		✓
Primary energy:	5407 kWh/Person yr		✓
Site energy:	16.46 kBtu/ft²/yr		✓

9:25 AM 21/09/2015



PHPP

Passive House Planning Package

Version 9 (2015) © Passive House Institute

2.5 Tips on Assembly R-Values

Sample R-Value Guidelines**

R-value ranges

Zone	Example Cities	Wall	Ceiling	Slab
1	Miami, FL or Honolulu, HI	19 - 27	44 - 60	2ft R-8 vertical perim.
2	Jacksonville, FL or Phoenix, AZ	19 - 27	30 - 70	Uninsulated
3	Charleston, SC or Sacramento, CA	15 - 31	30 - 60	Uninsulated, or 2-4ft R-8 vertical perim.
Marine 3	San Francisco, CA	19 - 23	30 - 38	4ft R8-20 vertical perim.
4	Baltimore, MD or Amarillo, TX	31 - 51	49 - 80	2-4ft R8-20 vertical perim.
Marine 4	Salem, OR or Seattle, WA	31 - 43	60 - 70	4ft R-20 vertical perim., or whole-slab R-20
5	Providence, RI or Flagstaff, AZ	31 - 43	60 - 70	4ft R-20 vertical perim., or whole-slab R-20
6	Burlington, VT or Billings, MT	39 - 51	70 - 90	whole-slab R20-28
7	Duluth, MN or Edmonton, AB	49 - 65	80 - 90	whole-slab R28-40
8	Fairbanks, AK	89	120	whole-slab R-40

** actual values will vary by project



Air Tightness

CFM @ 50 / Square Feet
Building Envelope

Use to be .6 ACH

Now .005

5+ Story buildings with
no combustion can be
.008



Source Energy Limits per year

Residential

6200 kwh / per person

Bedrooms +1 = Persons

Protip - Keep spaces below 500 square feet to hit the target

Variations on Mixed Use Buildings

Going to 4200 in V2018

Commercial / Multifamily

38kbtu per interior conditioned floor area (iCFA)

Process Load variations

Other requirements

Reduced Thermal Bridge issues

Intense Moisture & Humidity Management

Efficient Ventilation capable of .3 air changes per hour at maximum

ASHRAE 62.2 residential or 62.1 commercial 2010

Follow indoor air plus

Follow zero energy ready

Follow Energy Star High Rise Certification

	Heating Demand/Load*	Cooling Demand/Load*	AIR-TIGHTNESS (cfm50/sf envelope)	Source Energy Demand	Renewable Generation for Source Zero
SINGLE FAMILY	1 - 16.8 kBTU/ft ² .yr 0 - 7.6 BTU/hr.ft ²	1 - 23.4 kBTU/ft ² .yr 1.3 - 9.5 BTU/hr.ft ²	0.05	6200 kWh/person.yr	>Source Energy Demand
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3. Thermal bridge-free construction <0.006 BTU/hr. ft °F

**WHO NEEDS TO BE
INVOLVED?**

PHIUS+ QA/QC - required

- PHIUS + Rater - Single Family / Lowrise Multifamily
 - Credentials
 - RESNET OR BPI
 - Experience
 - HERS rating, Energy Star and/or LEED for Homes
 - Building Construction / design / engineering
 - Training - 2 days + exam \$500.00
 - Maintain (Yearly) - Proof of HERS credential and (Rate or attend trainings)

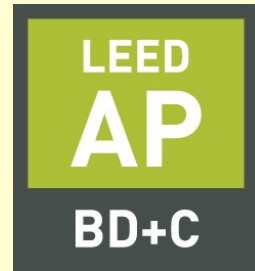
- PHIUS + Verifier - Mid - high rise Multifamily / Commercial
 - Credentials
 - RESNET OR BPI
 - Experience
 - Midrise / Highrise energy or green programs
 - Building Construction / design / engineering
 - Training - 2 days + exam \$625.00
 - Maintain (Yearly) - Rate or attend trainings





Certified Passive House Consultant (CPHC) -

highly recommended



<http://www.phius.org/become-a-professional/certified-passive-house-consultant-cphc-training/program-overview>

Michigan

Architectural Resource, LLC

CPHC

Dale Babcock #2081
dbabcock@architecturalresource.com

2301 Platt Road, Suite 30
Ann Arbor, Michigan 48104

Alex Jackson #2319
ajackson@architecturalresource.com

Susan Karczag, AIA Assoc. #2080
skarczag@architecturalresource.com

Michael Klement, AIA #2076
mklement@architecturalresource.com

Biddison Architecture

CPHC

Mrunmayee Beke #2079
mrunmayee.beke@gmail.com

320 Martin St
Suite LL10
Birmingham, Michigan 48009

Catalyst Partners

CPHC

Jamison Lenz #2317
jamison@catalyst-partners.com

502 Second St
Ste 200
Grand Rapids, Michigan 49504

Equilibrium Energy Spaces

CPHC

Christina Snyder #1137
CASnyder@ic.org

Michigan

Meadowlark Design + Build

CPHC

Brian Burkett #2388
brian@homewithmeadowlark.com

3250 West Liberty
Ann Arbor, Michigan 48103

Sturgeon Bay Woodworks Inc.

CPHC

Steve Johnston #1139
sturgeonww@gmail.com

5440 Old Island Rd.
sturgeonww@gmail.com
Levering, Michigan 49755

PHIUS Builders- highly recommended



Michigan

Habitat for Humanity of Kent County

PHIUS Certified Builder

Brandyn Deckinga #1903
bdeckinga@habitatkent.org

425 Pleasant Ave SW
Grand Rapids, Michigan 49503

Robinson Sustainable Builders, LLC

PHIUS Certified Builder

Andra Robinson #1644
OnjTR@aol.com

1901 Katie Court
Portage, Michigan 49024

**What is the
PROCESS?**

Steps

1. Understand the program and/or high CPHC
2. Sign PHIUS contract & Register Project
3. Access drop box PHIUS folder
4. Hire the PHIUS+ Rater
5. Sub slab insulation inspection
6. Predrywall inspection
7. Final site testing
8. Final documentation assembly
9. Rater submits to PHIUS
10. Adjustments or review if needed
11. Certification notice
12. Order plaque
13. Celebrate success

**Documentation
Heavy!**

5. PHIUS+ Certification Fee Schedule

PHIUS quotes a single fee for the full certification process, rather than a separate fee for pre-certification and final certification. Certification fees are based upon the project's calculated square feet of iCFA (interior conditioned floor area).

PHIUS' quoted fees do not include the cost of the QA/QC visits and final on-site testing, which are determined by the PHIUS+ Rater/Verifier of choice, see Section 3.7.

iCFA	0-2500 ft ²	2501-4500 ft ²	4501+ ft ²	Hourly Rate
Base Rate	\$1,500	\$2,000	Custom*	\$150/hr.
PHIUS Professional (CPHC, Builder) & PHAUS Member	\$1,275	\$1,700	Custom*	\$125/hr.

*For projects larger than 4500 square feet, a custom quote is required. To request a quote, please email certification@passivehouse.us and provide the estimated iCFA (see Section 4.4.1.4).

Here are estimated fees for larger buildings:

iCFA	10,000 ft ²	20,000 ft ²	50,000 ft ²	100,000 ft ²	200,000 ft ²	500,000 ft ²
Base Rate	\$4,000	\$6,750	\$11,875	\$16,250	\$21,875	\$33,125
PHIUS Professional & PHAUS Member	\$3,400	\$6,150	\$11,275	\$15,650	\$21,275	\$32,525

PHIUS Professionals that are also PHAUS Professional Members receive a 15% discount, up to \$600.

Non-Profit Organizations such as Habitat for Humanity are eligible for a larger discount, by request.



Passive House Institute US

Passive House Goes with LEED

Project teams that are considering pursuing PHIUS certification may now use this third-party-verified home performance standard to earn credit toward LEED certification. This alignment offers builders and developers greater opportunity to more cost-effectively apply the best practices and verification strengths of both Passive House and LEED to produce high-performing, green homes for families all across the United States.

As part of the [October 2016 addenda release](#), USGBC introduced [Passive House US alternative compliance path for North America](#), which allows projects to leverage their PHIUS label to earn points toward LEED v4 certification under LEED v4 BD+C: Homes.

By earning the PHIUS certificate, projects can be awarded a minimum of 31.5 points in LEED v4 BD+C: Homes, as well as most prerequisites in the Energy and Atmosphere and Indoor Environmental Quality credit categories. Additional points can be earned by demonstrating achievement of a HERS Index score of 40 or better. Projects must earn at least 40 points in LEED to earn the first of four rungs of certification: [Certified \(40\)](#), Silver (50), Gold (60) and Platinum (80).

Credit-specific details

PHIUS-certified projects [automatically earn](#) 20 points in EA [Annual energy use](#) (20 points).

Because PHIUS projects must also earn the DOE ZERH label, they automatically meet the following LEED v4 Homes credits and prerequisites, as specified in Interpretation 10431:

31.5 points

<https://www.usgbc.org/articles/use-passive-house-us-earn-credit-toward-lead-certification>



Need help? Contact education@usgbc.org

113 completions

All about the PHIUS+ 2015: The Climate Specific Passive Building Standard

GBCI: 0920011466

Passive House Certification is a growing standard that goes beyond energy efficiency and residential buildings by also ensuring health and durability in all building types, new or renovation with specific standards that help those in different climate zones.



Rating system: v4, v2009

Published on: November 17, 2016

Average: 4.2 (12 votes)



<https://www.usgbc.org/education/sessions/all-about-phius-2015-climate-specific-passive-building-standard-10557043>



Thank you!
Questions?

Brett.Little@greenhomeinstitute.org



Panasonic
Ventilation

