Climate Specific Passive Building Standards for the US:

Principles, Metrics, Lessons learned

Katrin Klingenberg

Executive Director | PHIUS

National Center for Appropriate Technology Montana

Source: National Center for Appropriate Technology: Superinsulation - A Housing Trend for the Eighties

Website National Center for Appropriate Technology: http://www.ncat.org/

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National Center for Appropriate Technology Montana

or recommendation of the product by the National Center for Appropriate Technology to the exclusion of others that may be suitable.

A. Groups/Individuals in the Field

National Center for Appropriate Technology (NCAT)
P.O. Box 3838, Butte, Montana 59701
Contact: Robert Corbett, Wally Hansen
NCAT has designed a low-cost superinsulated house. Plans and specifications for that design will be available in the Fall of 1980. Write to NCAT's Building Technology Section for more information.

Small Homes Council
Building Research Council
University of Illinois at Urbana Champaign, IL 61801
The first group to thoroughly research superinsulated houses, the Small Homes Council designed their "Lo-Cal House" in 1976. Their report, *Technical Note 14, Details and Engineering Analysis of the Illinois Lo-Cal House*, is an excellent source of information. ($7.50).

William A. Shurcliff
19 Appleton Street
Cambridge, MASS 02138
Shurcliff recently published (March, 1980) a comprehensive manuscript on the subject entitled *Superinsulated Houses and Double-Envelope Houses, A Preliminary Survey of Principles and Practice of Superinsulation*. ($10.00).

Mid-America Solar Energy Complex (MASEC)
8140 26th Ave., South
Bloomington, MN 55420
MASEC has prepared an information packet on superinsulation that is available at no charge.

Energy Research Development Group
Department of Mechanical Engineering
University of Saskatchewan
Saskatoon, Saskatchewan, S7N 0W0
This group probably has more experience than any other working in the field. As they are constantly updating their research and publications, contact them for a current listing (and prices).

B. Exterior Insulation System Manufacturers

Source: National Center for Appropriate Technology: Superinsulation - A Housing Trend for the Eighties

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Shurcliff Paper

Ann. Rev. Energy 1986. 11: 1–24
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SUPERINSULATED HOUSES

William A. Shurcliff

Physics Department, Harvard University, Cambridge, Massachusetts 02138

INTRODUCTION

Superinsulation is a direct response to the fast-rising cost of home heating. Of the many kinds of responses, superinsulation is proving to be the simplest and most cost-effective.

Until the oil embargo of 1973 there was little interest in saving heat.

Republished by the University of Wyoming, 9/16/11

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Improvements

In conclusion, superinsulation appears to be an outstandingly successful strategy for building high-comfort, low-cost houses that require little heat in winter and little cooling in summer. Passive solar heating may be preferred by persons with special requirements, such as greenhouses, sunspaces, or enormous window areas for view. In some circumstances active solar heating may be the appropriate choice. But for persons whose main goals are high comfort, low initial cost, and low operating cost, superinsulation appears to be the logical choice.

Literature Cited

1. Balcomb, J. D., Jones, W. R., McFarland, E. D., Wray, W. O. 1984. *Passive Solar Heating Analysis.* Atlanta, Georgia: Am. Soc. Heating, Refrigerating and Air-Conditioning Engineers. 820 pp.
2. Booth, D. 1983. *Sun/Earth Buffering and Superinsulation.* Canterbury, New Hampshire: Community Builders. 230 pp.
3. Lstiburek, J. W., Lischkoff, J. K. 1984. *A New Approach to Affordable Low Energy House Construction.* Edmonton

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Summary

1. PH Metrics
   - Current Metrics reviewed
2. PH Principles
   - Comfort Criteria
   - Peak Load Criteria
   - Influence of Envelope
3. Lessons Learned
   - Climate Specific Implications
   - Proposal of adjusting Standard

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Current Metrics

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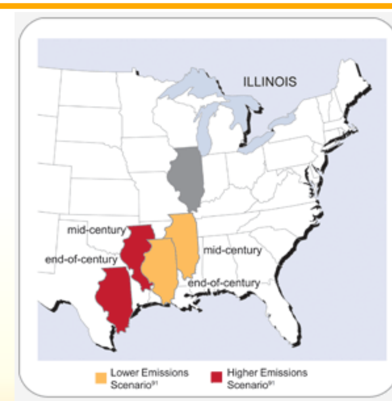
Climate on the Move



Source: www.globalchange.gov

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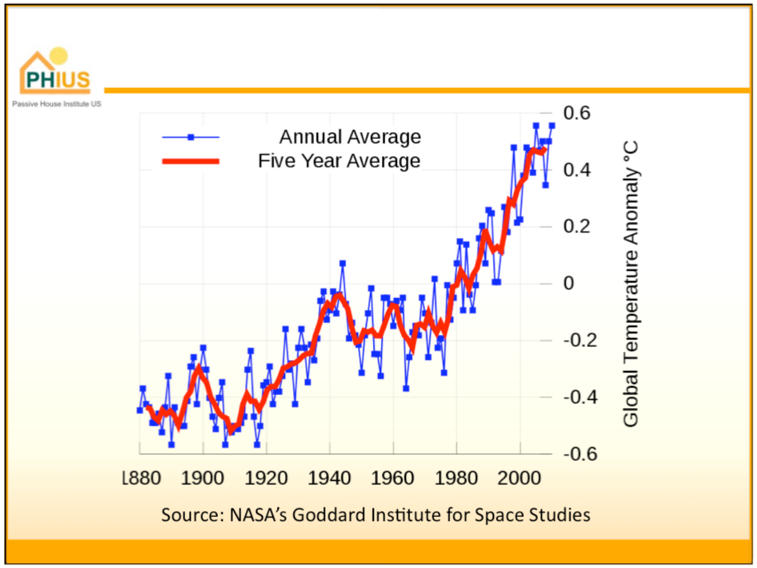
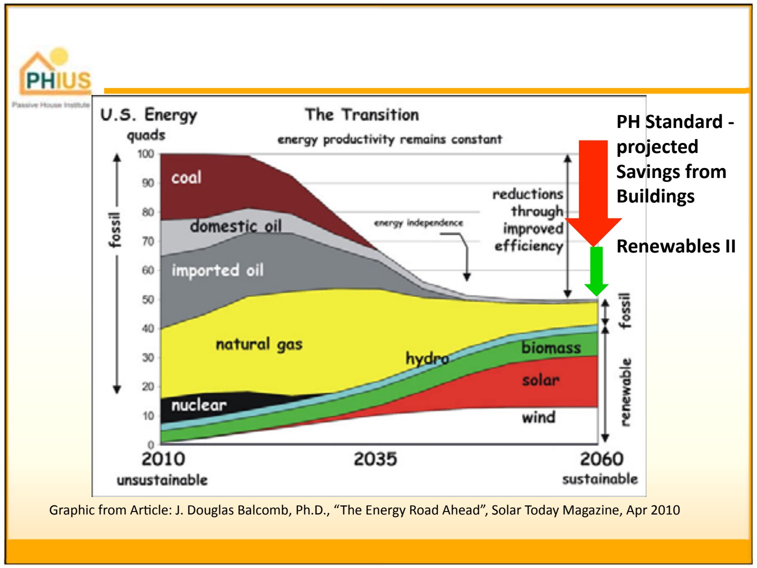
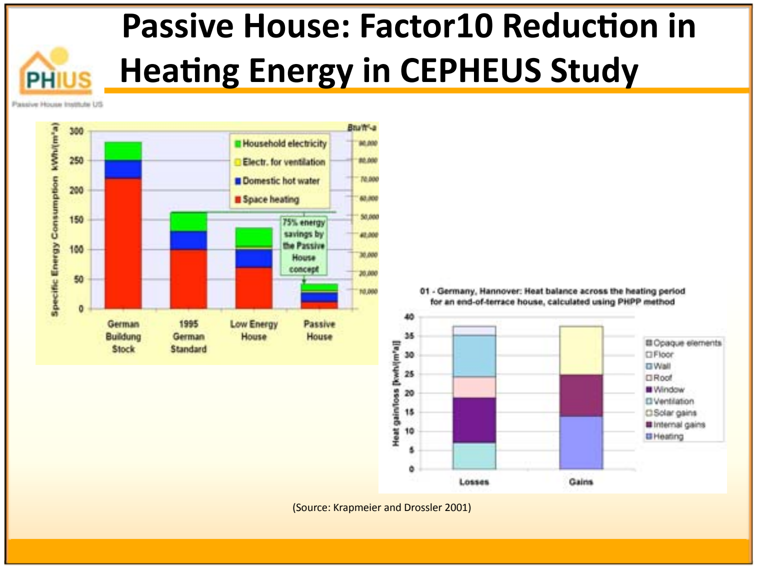

PHIUS
Passive House Institute US
Annual Average
Five Year Average
Global Temperature Anomaly °C
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1880 1900 1920 1940 1960 1980 2000
Source: NASA's Goddard Institute for Space Studies


PHIUS
U.S. Energy
quads
The Transition
energy productivity remains constant
coal
domestic oil
imported oil
natural gas
nuclear
hydro
biomass
solar
wind
energy independence
reductions through improved efficiency
fossil
renewable
2010
unsustainable
2035
2060
sustainable
PH Standard - projected Savings from Buildings
Renewables II
Graphic from Article: J. Douglas Balcomb, Ph.D., "The Energy Road Ahead", Solar Today Magazine, Apr 2010


Passive House: Factor10 Reduction in Heating Energy in CEPHEUS Study
PHIUS
Passive House Institute US
Specific Energy Consumption kWh/(m²a)
Btu/ft²-a
Household electricity
Electr. for ventilation
Domestic hot water
Space heating
75% energy savings by the Passive House concept
German Buildung Stock
1995 German Standard
Low Energy House
Passive House
01 - Germany, Hannover: Heat balance across the heating period for an end-of-terrace house, calculated using PHPP method
Heat gain/loss [kWh/(m²a)]
Opaque elements
Floor
Wall
Roof
Window
Ventilation
Solar gains
Internal gains
Heating
Losses
Gains
(Source: Krapmeier and Drossler 2001)


PHIUS+ Certification: Blake Bilyeu 2010, Salem, OR
PHIUS
Passive House Institute US

Passive House Factor10 Reduction in Heating Energy significantly exceeded!

PHIUS

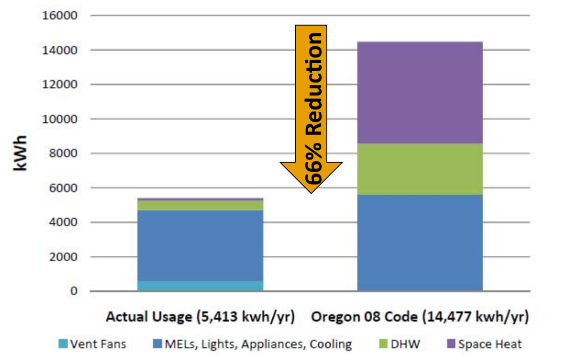
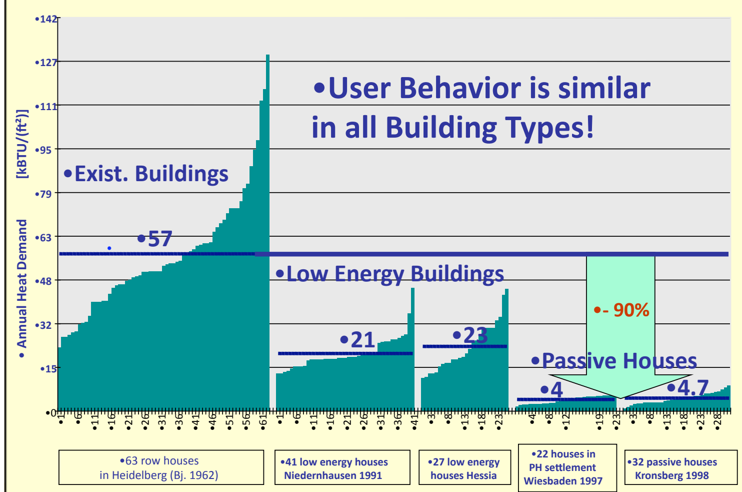


Figure 7: Actual Energy Use Compared to OR 2008 Code Home

Statistics Show importance of mean measured values



Passive House Standard – Metrics & Certification Criteria:

PHIUS

Energy Metrics

(discounted interior conditioned floor area - TFA)

Annual Heating Energy Demand	≤4.75 kBTU/ft² yr or 1.4 kWh/ft² yr [15 kWh/m²a]
Annual Cooling Energy Demand	≤4.75 kBTU/ft² yr or 1.4 kWh/ft² yr [15 kWh/m²a]
	-OR-
Peak Heating Load	≤3.17 BTU/hr.ft² or approx. 1 W/ft² [10 W/m²]
Peak Cooling Load	≤2.54 BTU/hr.ft² or approx. 0.75 W/ft² [8 W/m²]
	-AND-
Annual Total Primary Energy Demand	≤38 kBTU/ft² yr or 11.1 kWh/ft² [120 kWh/m²a]
Air Leakage @ 50 Pa	≤0.6 ACH_{50}

Passive House Standard – Compared to Conventional Energy Modeling

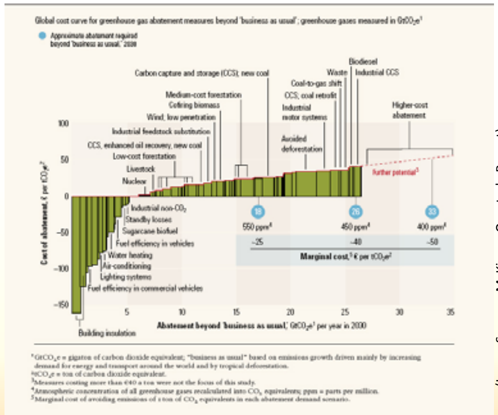
PHIUS

Energy Metrics

(exterior building dimensions as customary in US)

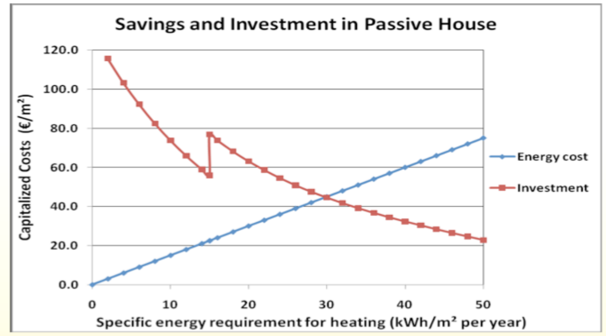
Annual Heating Energy Demand	≤3.325 kBTU/ft² yr or 0.97 kWh/ft² yr
Annual Cooling Energy Demand	≤3.325 kBTU/ft² yr or 0.97 kWh/ft² yr
Annual Total Primary Energy Demand	≤ 26.6 kBTU/ft² yr or 7.77 kWh/ft² yr
Peak Heating Load	≤2.22 BTU/hr.ft² or approx. 0.7 W/ft²
Peak Cooling Load	≤1.78 BTU/hr.ft² or approx. 0.53 W/ft²

Conservation is Most Cost Effective CO2 Abatement Measure



(Image Source: McKinsey Quarterly Report)

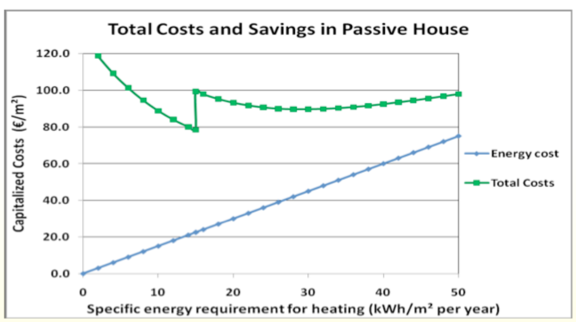
Costs and Estimates International Energy Agency



Note: Costs are for central Europe (Germany)

(Source: IEA Information Paper: Energy Efficiency requirements in Building Codes, Author Jens Laustsen)

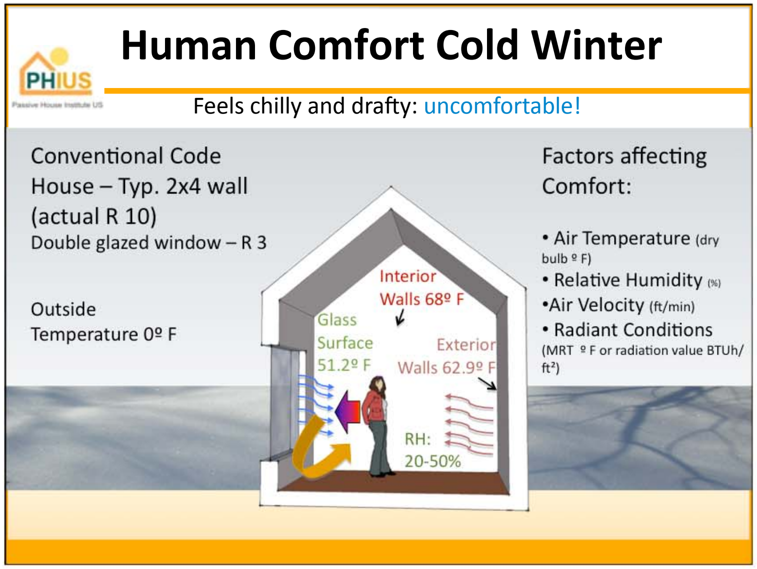
Costs and Estimates International Energy Agency



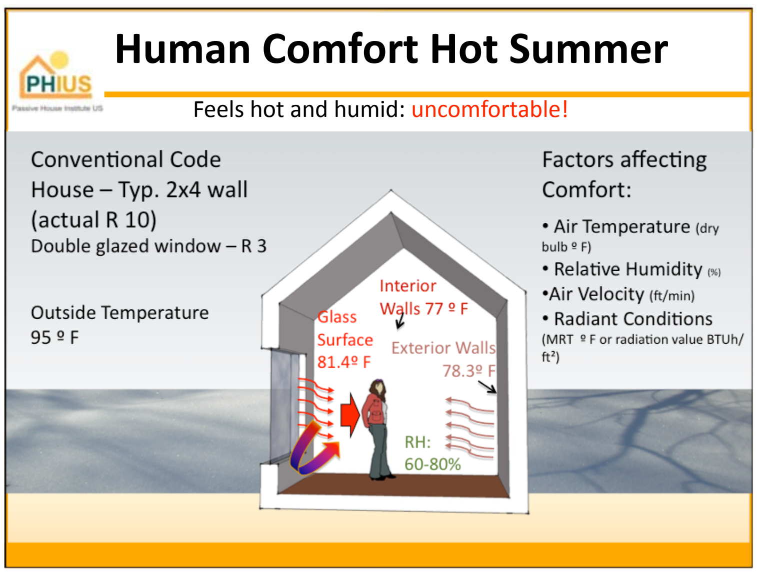
Note: Costs are for central Europe (Germany)

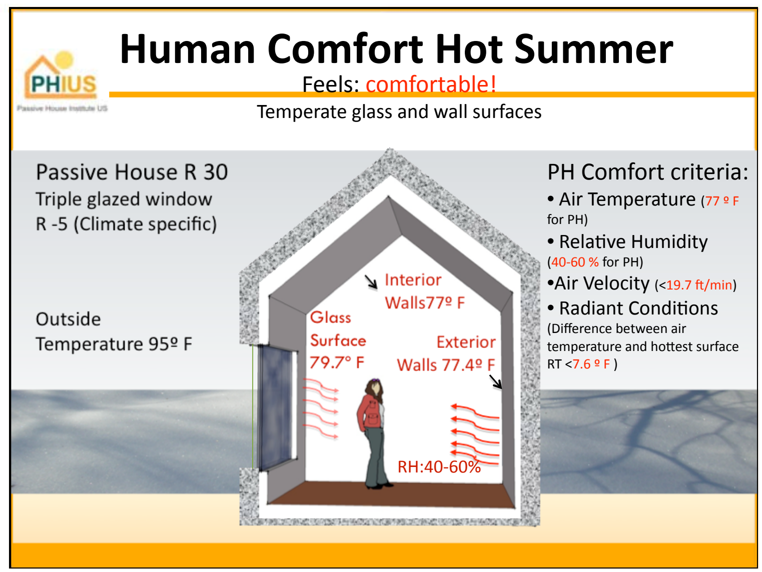
(Source: IEA Information Paper: Energy Efficiency requirements in Building Codes, Author Jens Laustsen)

Underlying Universal Principles


Human Comfort Cold Winter
PHIUS
Passive House Institute US
Feels chilly and drafty: uncomfortable!
Conventional Code House – Typ. 2x4 wall (actual R 10)
Double glazed window – R 3
Outside Temperature 0º F
Interior Walls 68º F
Glass Surface 51.2º F
Exterior Walls 62.9º F
RH: 20-50%
Factors affecting Comfort:
• Air Temperature (dry bulb º F)
• Relative Humidity (%)
•Air Velocity (ft/min)
• Radiant Conditions
(MRT º F or radiation value BTUh/ft²)


Human Comfort Cold Winter
PHIUS
Passive House Institute US
Feels: comfortable!
Temperate glass and wall surfaces and no drafts
Passive House R 60
Triple glazed window
R -9 (Climate specific)
Outside Temperature 0º F
Interior Walls 68º F
Glass Surface 62.4° F
Exterior Walls 67.1º F
RH:40-50%
PH Comfort criteria:
• Air Temperature (68 º F)
• Relative Humidity (40-60 % for PH)
•Air Velocity (<19.7 ft/min)
• Radiant Conditions
(Difference between air temperature and coldest surface 68 -RT <7.6 º F)


Human Comfort Hot Summer
PHIUS
Passive House Institute US
Feels hot and humid: uncomfortable!
Conventional Code House – Typ. 2x4 wall (actual R 10)
Double glazed window – R 3
Outside Temperature 95 º F
Interior Walls 77 º F
Glass Surface 81.4º F
Exterior Walls 78.3º F
RH: 60-80%
Factors affecting Comfort:
• Air Temperature (dry bulb º F)
• Relative Humidity (%)
•Air Velocity (ft/min)
• Radiant Conditions
(MRT º F or radiation value BTUh/ft²)


Human Comfort Hot Summer
PHIUS
Passive House Institute US
Feels: comfortable!
Temperate glass and wall surfaces
Passive House R 30
Triple glazed window
R -5 (Climate specific)
Outside Temperature 95º F
Interior Walls77º F
Glass Surface 79.7° F
Exterior Walls 77.4º F
RH:40-60%
PH Comfort criteria:
• Air Temperature (77 º F for PH)
• Relative Humidity (40-60 % for PH)
•Air Velocity (<19.7 ft/min)
• Radiant Conditions
(Difference between air temperature and hottest surface RT <7.6 º F)

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Peak Load Criteria

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European Criteria - Heating

Annual Heat Demand ☒ 4.75 kBTU/ft²yr (15 kWh/m²a)

Peak Heat Load ☒ approx. 3.17 BTU/hr.ft² or 1W/ft² (10 W/m²)

Primary Energy Demand ☒ 38 kBTU/ft²yr (120 kWh/m²a)

Airtightness ☒ 0.6 ACH_{50}

Ventilation ☒75% Recovery, ≥0.76 W/cfm

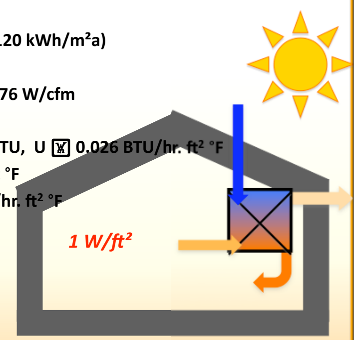
Thermal Envelope: R ☒ 38.5 hr. ft² °F/BTU, U ☒ 0.026 BTU/hr. ft² °F

Thermal-bridge Free Ψ ☒ .006 BTU/ hr. ft °F

Windows installed: $U_{w\text{-}install}$ ☒ 0.15 BTU/hr. ft² °F

SHGC 50 – 55 %

Note: Window and Thermal envelope criteria Listed are for a Central European Climate. Recommendations for these values vary In N America based on climate



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Peak Load Criteria - Heating

$$P_{H,\,Supply} = V * ☒☒ * ☒c_p$$

$$= 3.28\ ft^3/(hr\ ft^2) * 58\ °F * 0.0177\ BTU/ft^3\ °F)$$

$$= 3.37\ BTU/hr.\ Ft^2\ (10.63\ W/m^2)$$

$P_{H,\,Supply}$ Peak Heat Load

V Ventilation Rate (per person per area)

☒☒ Difference between 68 F and 126 F

☒c_p Heat capacity of air

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European Criteria - Cooling

Annual Cooling Demand ☒ 4.75 kBTU/ft²yr (15 kWh/m²a)

Peak Cooling Load ☒ approx. 2.55 BTU/hr.ft² or 0.75W/ft² (8 W/m²)

Primary Energy Demand ☒ 38 kBTU/ft²yr (120 kWh/m²a)

Airtightness ☒ 0.6 ACH_{50}

Ventilation Cooling ☒xx% Recovery, ≥0.76 W/cfm

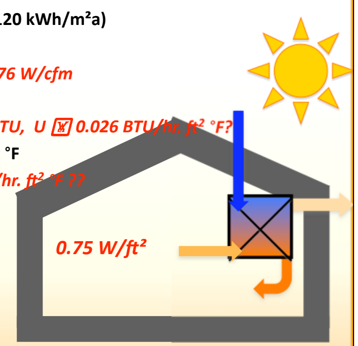
Thermal Envelope: R ☒ 38.5 hr. ft² °F/BTU, U ☒ 0.026 BTU/hr. ft² °F?

Thermal-bridge Free Ψ ☒ .006 BTU/ hr. ft °F

Windows installed: $U_{w\text{-}install}$ ☒ 0.15 BTU/hr. ft² °F ??

SHGC 50-55%

**Note: Window and Thermal envelope criteria Listed are for a Central European Climate. Recommendations for these values vary In N America based on climate*



Peak Load Criteria - Cooling

$P_{C,\ Supply}$ = V * ⌧⌧ * ⌧c_p

= *3.28 ft³/(hr ft²)* * 44 °F * 0.0177 BTU/ft³ °F

= 2.55 BTU/hr. ft² (0.75 W/ft²)

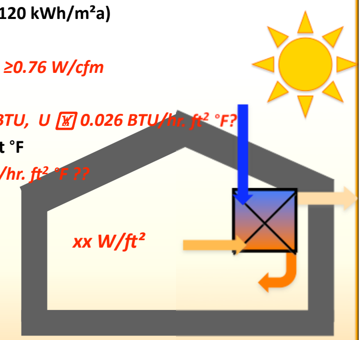
$P_{C,\ Supply}$	Peak Cooling Load
V	*Ventilation Rate (per person per area)*
⌧⌧	Difference between 77 ° F and 33 ° F
⌧c_p	Heat capacity of air

European Criteria – Dehumidification?

Annual Cooling Demand	⌧ 4.75 kBTU/ft²yr (15 kWh/m²a)
Peak Latent Load	*⌧ approx. xxx BTU/hr.ft² or xxxW/ft² (xx W/m²)*
Primary Energy Demand	⌧ 38 kBTU/ft²yr (120 kWh/m²a)
Airtightness	⌧ 0.6 ACH_{50}
Ventil. Hygrical Recovery	*⌧xx% Recovery ?? , ≥0.76 W/cfm*
Thermal Envelope:	*R ⌧ 38.5 hr. ft² °F/BTU, U ⌧ 0.026 BTU/hr. ft² °F?*
Thermal-bridge Free	Ψ ⌧ .006 BTU/ hr. ft °F
Windows installed:	*$U_{w\text{-}install}$ ⌧ 0.15 BTU/hr. ft² °F ??*

SHGC 50-55%??

**Note: Window and Thermal envelope criteria Listed are for a Central European Climate. Recommendations for these values vary In N America based on climate*



Total Peak Heat Load:

$$P_H = P_T + P_V - (P_S + P_I)$$

P_T (BTU/hr) ***peak heat loss*** through entire envelope

P_V (BTU/hr) ***peak ventilation heat losses***

P_S (BTU/hr) ***peak solar heat gains***

P_I (BTU/hr) ***internal heat gains*** heat supply from internal heat sources

Energy Demands with Reference to the Treated Floor Area

Treated Floor Area: 1242 ft²

	Applied:	Monthly Method		PH Certificate:	Fulfilled?
Specific Space Heat Demand:	4.75	kBTU/(ft²yr)		4.75 kBTU/(ft²yr)	Yes
Pressurization Test Result:	0.45	ACH_{50}		0.6 ACH_{50}	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	36.7	kBTU/(ft²yr)		38.0 kBTU/(ft²yr)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	17.8	kBTU/(ft²yr)			
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kBTU/(ft²yr)			
Heating Load:	3.06	BTU/(ft²hr)			
Frequency of Overheating:		%	over 77.0 °F		
Specific Useful Cooling Energy Demand:	0.03	kBTU/(ft²yr)		4.75 kBTU/(ft²yr)	Yes
Cooling Load:	0.97	BTU/(ft²hr)			

			P_G 1 BTU/hr		P_G 2 BTU/hr
Heat Gains P_G	$P_S + P_I$	=	1522	or	746
	$P_L - P_G$	=	3797	or	3375
Heating Load P_H		=	3797 BTU/hr		
Specific Heating Load P_H / A_{TFA}		=	3.1 BTU/hr.ft²		

Input Max. Supply Air Temperature 126 °F

Max. Supply Air Temperature $\vartheta_{Supply,Max}$ 126 °F

Supply Air Temperature Without Heating $\vartheta_{Supply,Min}$ 60 °F 62 °F

For Comparison: Heating Load Transportable by Supply Air. $P_{Supply\ Air,Max}$ = 3879 BTU/hr specific 3.1 BTU/hr.ft²

Supply Air Heating Sufficient? Yes

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Energy Demands with Reference to the Treated Floor Area

Treated Floor Area: 1242 ft²

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Specific Space Heat Demand:	4.60	kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	Yes
Pressurization Test Result:	0.45	ACH_{50}	0.6 ACH_{50}	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	33.3	kBTU/(ft²yr)	38.0 kBTU/(ft²yr)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	14.4	kBTU/(ft²yr)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kBTU/(ft²yr)		
Heating Load:	4.71	BTU/(ft²hr)		
Frequency of Overheating:		%	over 77.0 °F	
Specific Useful Cooling Energy Demand:	0.25	kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	Yes
Cooling Load:	2.29	BTU/(ft²hr)		

			P_G 1 BTU/hr		P_G 2 BTU/hr	
Heat Gains P_G	$P_S + P_I$	=	1924	or	1529	
	$P_L - P_G$	=	5802	or	5853	
Heating Load P_H		=			5853	BTU/hr
Specific Heating Load P_H / A_{TFA}		=			4.7	BTU/hr.ft²

Input Max. Supply Air Temperature 126 °F

Max. Supply Air Temperature $\vartheta_{Supply,Max}$ 126 °F

Supply Air Temperature Without Heating $\vartheta_{Supply,Min}$: 58 °F / 58 °F

For Comparison: Heating Load Transportable by Supply Air. $P_{Supply\ Air,Max}$ = 3993 BTU/hr specific 3.2 BTU/hr.ft²

Supply Air Heating Sufficient? (Yes/No) No

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Energy Demands with Reference to the Treated Floor Area

Treated Floor Area: 1242 ft²

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Specific Space Heat Demand:	2.77	kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	Yes
Pressurization Test Result:	0.45	ACH_{50}	0.6 ACH_{50}	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	31.1	kBTU/(ft²yr)	38.0 kBTU/(ft²yr)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	12.3	kBTU/(ft²yr)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kBTU/(ft²yr)		
Heating Load:	3.47	BTU/(ft²hr)		
Frequency of Overheating:		%	over 77.0 °F	
Specific Useful Cooling Energy Demand:	0.12	kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	Yes
Cooling Load:	1.89	BTU/(ft²hr)		

Wall R-values increased to 110

Roof R-value increased to 170

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Influence of the Superinsulated Envelope on Mechanicals

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Climate Specific Recommendations Passive House

		SI Units	IP
1 Heat Load:		≤10 W/m²	≤ 1 W/ft²
Cooling Load:		≤ 8 W/m²	≤ 0.8 W/ft²
2 Envelope Insulation:			
Very Cold/humid	Minneapolis, MN	U≤0.08 W/m²K	R≥71 hr-ft²-°F/Btu
Cold	Chicago, IL	U≤0.094 W/m²K	R≥60 hr-ft²-°F/Btu
Mixed/humid	Ashville, NC	U≤0.16 W/m²K	R≥35 hr-ft²-°F/Btu
Mixed/dry	Las Vegas, NV	U≤0.14 W/m²K	R≥40 hr-ft²-°F/Btu
Marine	Seattle, WA	U≤0.13 W/m²K	R≥44 hr-ft²-°F/Btu
Hot/humid	Houston, TX	U≤0.16 W/m²K	R≥35 hr-ft²-°F/Btu
Hot/dry	Phoenix, AZ	U≤0.16 W/m²K	R≥35 hr-ft²-°F/Btu
3 Thermal Bridge Free Construction:			
Linear Thermal Transmittance		Ψ≤0.01 W/mK	Ψ≤0.006 Btu/hr-ft-°F
4 High Performance Windows installed:			
Overall Thermal Transmittance (Very Cold)		*U*≤0.6 W/m²K	*U*≤0.11 Btu/hr-ft²-°F
Overall Thermal Transmittance (Cold/Mixed)		*U*≤0.85 W/m²K	*U*≤0.15 Btu/hr-ft²-°F
Overall Thermal Transmittance (Hot)		*U*≤1.55 W/m²K	*U*≤0.27 Btu/hr-ft²-°F
Solar Heat Gain Coefficient (Mixed/Cold)		g-value≥50%	SHGC≥50%
Solar Heat Gain Coefficient (Hot)		g-value ≤ 30%	SHGC ≤ 30%
5 Heat Recovery Ventilation:			
Net Efficiency		h≥80%	h≥80%
Electric Consumption of motor		≤0.45 Wh/m³	≤0.76 W/cfm

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Envelope Components

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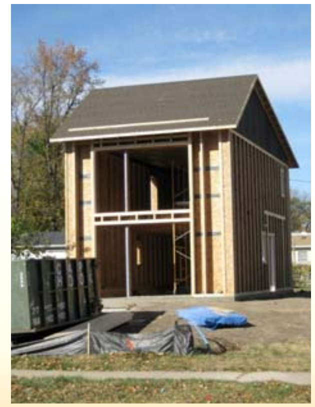

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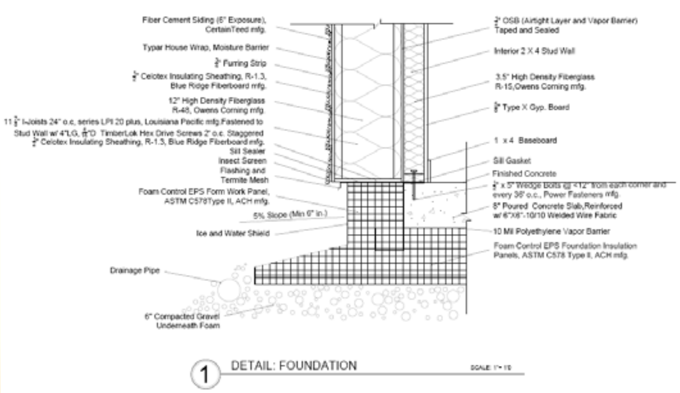

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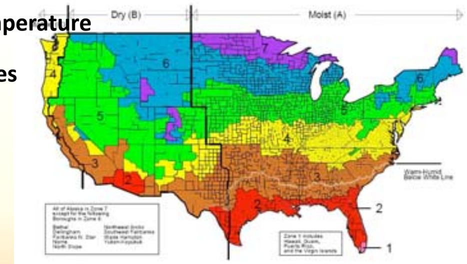
Affordable Dublin House – 2010, Urbana IL

Climate Specific Implications

Climate Factors that influence Comfort Conditioning needs

- Heating Degree Days
- Cooling Degree Days
- Winter Design Temperature
- Summer Design Temperature
- Ground Temperatures
- Humidity
- Solar Radiation
- Night Sky Radiation
- Altitude



Source: www.energycodes.gov

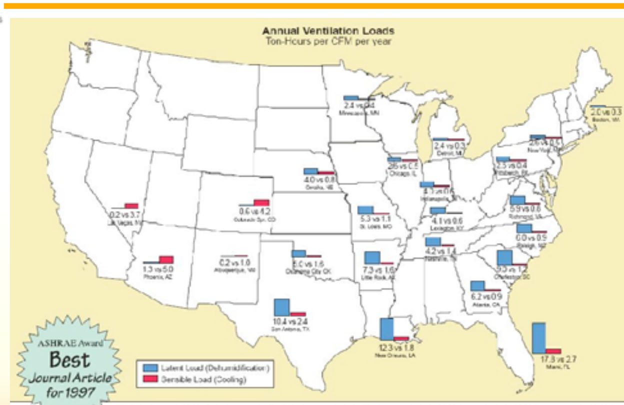


Fig. 1: Map of Ventilation Load indexes (VLI) for selected continental U.S. locations

(Image Source: from **ASHRAE Journal, November, 1997 pp 37 - 45**)

Worldwide Space conditioning Factors

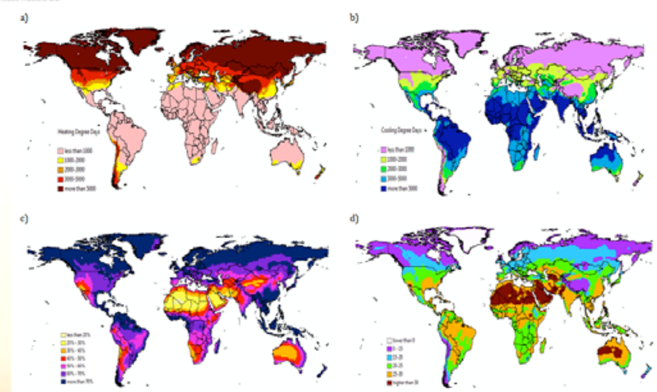
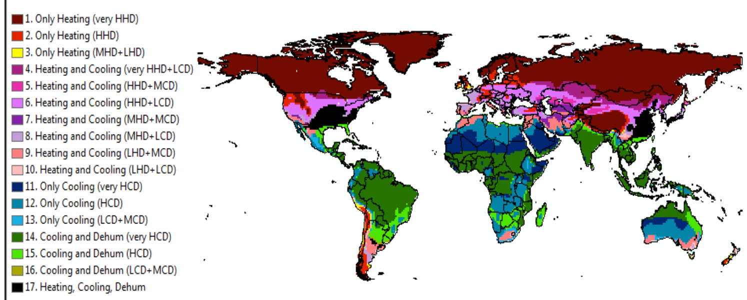


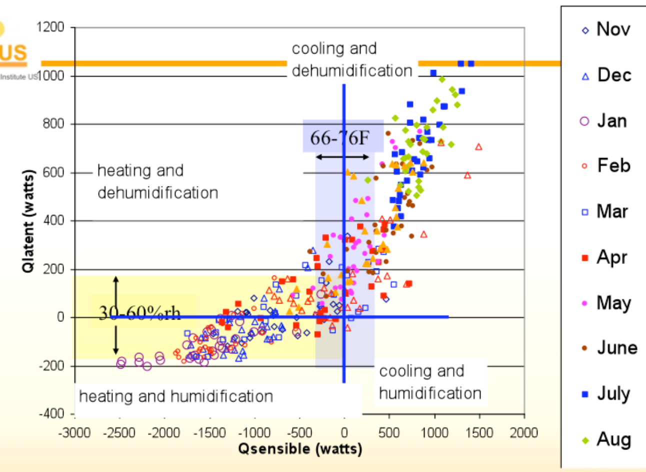
Figure 17. Input Parameters for Climate Split: a) Heating Degree Days, b) Cooling Degree Days; c) Relative Humidity (%); d) Average Air Temperature (°C)

Graphs Courtesy of Global Buildings Performance Network

Climate specific Space Conditioning Requirements



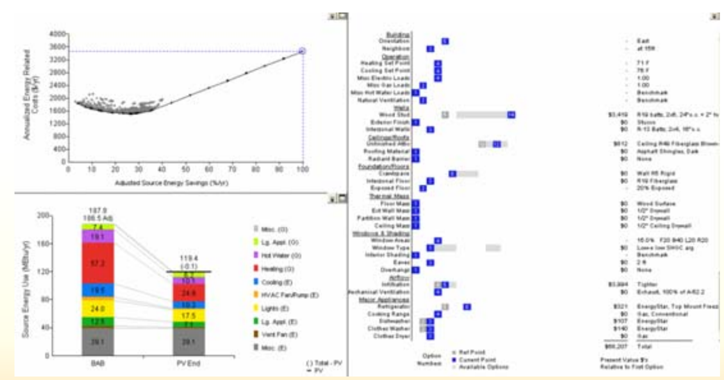
Graph Courtesy of Global Buildings Performance Network



Grafics: Newell Instruments, Inc.

Proposed US Standard Modification

Costs and Estimates
BEopt National Renewable Energy Lab

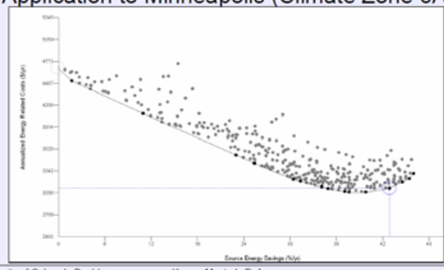


Climate specific optimized Space Conditioning and Economy

PHIUS Passive House Institute US

Method for Determining Climate-Dependent PH Standards

Application to Minneapolis (Climate Zone 6A)



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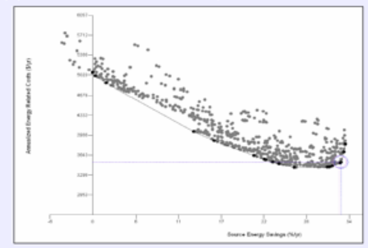
Climate specific optimized Space Conditioning and Economy

PHIUS Passive House Institute US

Method for Determining Climate-Dependent PH Standards

Application to Phoenix (Climate Zone 2B)



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Climate specific optimized Space Conditioning and Economy

PHIUS Passive House Institute US

Method for Determining Climate-Dependent PH Standards

Climate Zone	City	Space Conditioning Demand kBtu/ft²·yr	Corresponding Heating Demand kBtu/ft²·yr	Corresponding Cooling Demand kBtu/ft²·yr
5	Hamburg	5.28	4.61	0.67
1A	Miami	15.23	0.00	15.23
2A	Houston	7.54	0.55	6.99
2B	Phoenix	13.61	0.00	13.61
3A	Atlanta	5.69	2.32	3.37
3B	Las Vegas	8.53	0.64	7.89
3B	Los Angeles	0.52	0.41	0.11
3C	San Francisco	0.01	0.00	0.01

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Climate specific optimized Space Conditioning and Economy

PHIUS Passive House Institute US

Method for Determining Climate-Dependent PH Standards

Climate Zone	City	Space Conditioning Demand kBtu/ft²·yr	Corresponding Heating Demand kBtu/ft²·yr	Corresponding Cooling Demand kBtu/ft²·yr
5	Hamburg	5.28	4.61	0.67
4A	Baltimore	5.88	3.83	2.05
4B	Albuquerque	3.22	0.97	2.25
4C	Seattle	1.20	0.63	0.57
5A	Chicago	6.61	3.29	3.32
5B	Denver	4.28	2.62	1.65
6A	Minneapolis	6.90	3.53	3.37
6B	Helena	3.14	1.96	1.18
7	Duluth	5.06	4.24	0.82
8	Fairbanks	13.71	13.60	0.11

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PHIUS+ Certified US Passive Projects

www.passivehouse.us/projects

Certified PHIUS Projects

Click on headings to sort

No.	Project	Submitted	Status	Lead CPHC	Year	Location	Constr. type	Bldg. function	Floor area	Project type
1055	1206 Lemon	Oct. 6, 2011	Certified	Katy Hollbacher		Menlo Park, CA	Timber	Single Family	2,968 s.f.	New Construction
1025	Beaton Residence	Jul. 18, 2011	Certified	Paul W Panish	2011	Shrewsbury, MA	Timber	Single Family	3,184 s.f.	New Construction
1031	Bio Haus	Jul. 18, 2011	Certified	Not in system	2006	Bemidji, MN	Timber	Mixed-Use	5,000 s.f.	New Construction
1045	Branch's Bend	Sep. 12, 2011	Certified	John Essig		Onancock, VA	Timber	Single Family	4,538 s.f.	New Construction
1015	Breezeway House	Jul. 13, 2011	Certified	David Brach	2009	Salt Lake City, UT	Timber	Single Family	2,778 s.f.	New Construction
1009	Center for Design Research (CDR)	Jun. 17, 2011	Pre-certified	Ryan Abendroth		Lawrence, KS	Timber	Government		New Construction
1019	Center for Energy Efficient Design (CEED)	Jul. 13, 2011	Certified	Adam Cohen		Roanoke, VA	Timber	School	3,053 s.f.	New Construction
1036	Cleveland Farm	Jul. 18, 2011	Certified	Katrin Klingenberg	2007	MA	Timber	Single Family		New Construction
1013	Corehaus	Jul. 8, 2011	Certified	Robert Hawthorne	2010	Portland, OR	Mixed timber-masonry	Single Family	1,175 s.f.	New Construction
1028	Fairview I	Jul. 18, 2011	Certified	Katrin Klingenberg	2006	Urbana, IL	Timber	Single Family		New Construction
1029	Fairview II	Jul. 18, 2011	Certified	Katrin Klingenberg	2007	Urbana, IL	Timber	Single Family	1,242 s.f.	New Construction
1027	Falmouth	Jul. 18, 2011	Certified	Mike Duclos	2011	Falmouth, MA	Timber	Single Family	1,353 s.f.	New Construction
1022	Gable Home - Illinois - US DOE'S 2009 Solar Decathlon	Jul. 16, 2011	Certified	Ryan Abendroth	2009	Champaign, IL	Timber	Single Family	506 s.f.	New Construction
1023	Habitat for Humanity, Charlotte, Vermont	Jul. 18, 2011	Certified	J.B. Clancy	2011	Charlotte , VT	Timber	Single Family	1,487 s.f.	New Construction

34 fully verified projects with over 100 more Projects currenty Registered in National Data Base to be completed!

Certified Passive House Consultants (CPHC)

www.passivehouse.us/consultants

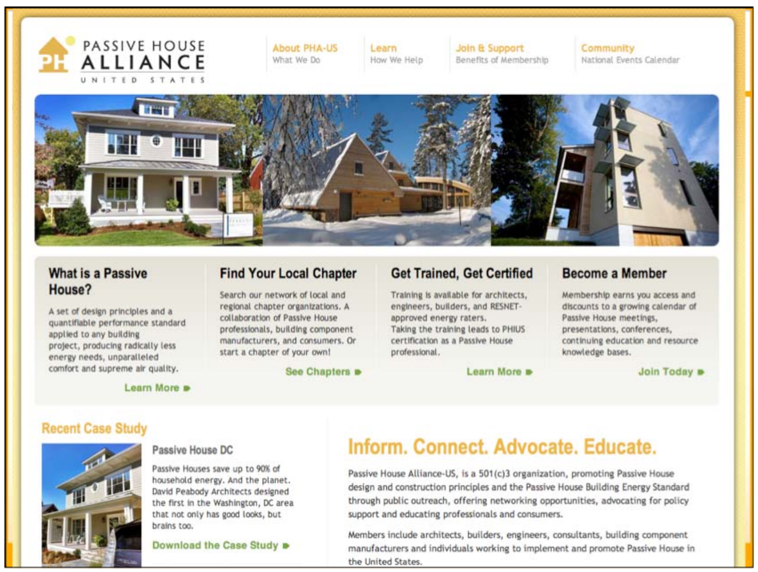
Certified PHIUS Consultants

Click on headings to sort

No.	Name	Company	Location
1122	Abendroth, Ryan	Passive Energy Designs LLC	St. Louis, MO
1057	Abrams, Alan	Abrams Design Build LLC	Takoma Park, MD
1092	Aiguier, Stephen	Green Hammer	Portland, OR
1226	Alessi, Alison	A+E Architects, Inc	Brewster, MA
1046	Angell, Bob		MD
1040	Anstey, Mark	JP Design	Jamaica Plain, MA
1042	Arena, Lois B.	Steven Winter Associates Inc.	Norwalk, CT
1091	Arnold, James	Green Building Contracting / Consulting	Portland, OR
1104	Arthur, Bill	Coalesce Inc.	Salt Lake City, UT
1129	Ascoli, Jean		Urbana, IL
1195	Backus, Rich	Timber Ridge Craftsmen, Inc.	Blue Ridge Mountains ~ Moneta, VA
1062	Balachowski, Joseph	National Park Service	Seattle, WA
1180	Bargetz, Sam	Loadingdock5 Architecture PLLC	Brooklyn, NY
1023	Barry, Bronwyn	Private Consultant	San Francisco, CA
1124	Bassett-Dilley, Tom	Tom Bassett-Dilley Architect Ltd.	Oak Park, IL
1171	Benzing, Andreas	A.M. Benzing Architects PLLC	New York, NY
1083	Bilyeu, Blake	Bilyeu Homes Inc.	Salem, OR
1184	Blau, Laura	GreenSteps	Philadelphia, PA
1090	Boetzel, Alexander	Green Hammer Construction	Portland, OR
1118	Bowman, Joe		Northfield, MN

322 Certified Professionals currently listed in National Data Base!

Visit our website for more information on scheduled trainings Nationwide!



In the News

New PHIUS Partners

1. Memorandum of Understanding between PHIUS and DOE –
   - Cooperation and Co-promotion of Certification Programs to promote zero energy homes
2. Memorandum of Understanding between PHIUS and Fraunhofer Institute for Building Science and Owens Corning –
   - Cooperation to develop the next gen modeling tool for passive buildings

Joe and Amory to Book-end!

Dr. Joe Lstiburek of Building Science Corporation to keynote!

Amory Lovins of the Rocky Mountain Institute to deliver closing plenary!

7th Annual North American Passive House Conference

Home Registration Pre-Conference Main Schedule Exhibitors Conference Hotel/Directions Sponsors Presenters

Pre-conference Workshops: September 27

Main Sessions: September 28-29

Passive House Projects Tour: September 30

Marriott City Center
1701 California Street
Denver, CO 80202