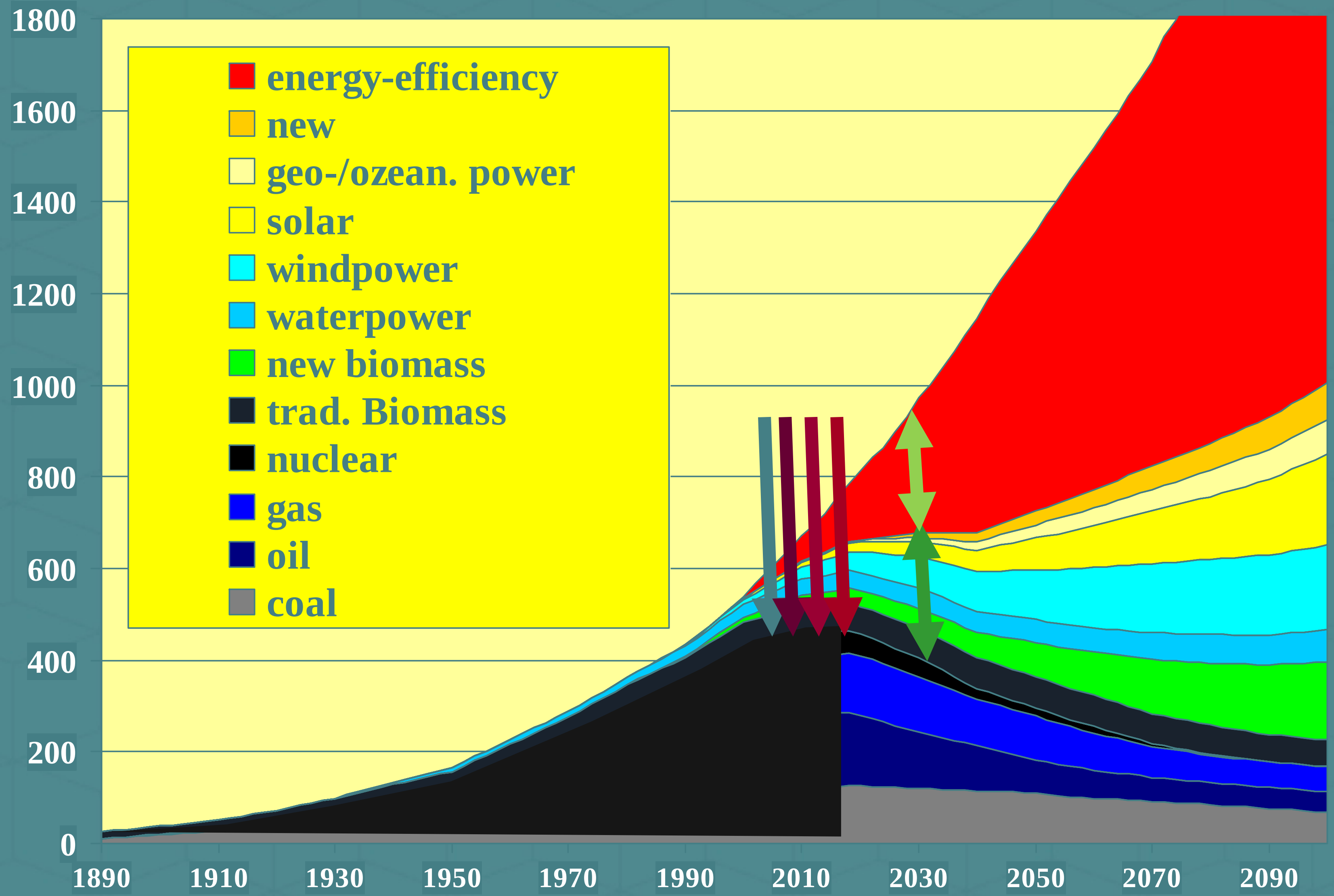
PASSIVE BUILDING STANDARDS AND RECENT POLICY DEVELOPMENTS

FUTURE WORLDWIDE TRANSITION



Reference: Shell-Study (till 2005), Scenario with high efficiency and regenerative usage of energy

PHIUS+ PROJECTS NATIONWIDE

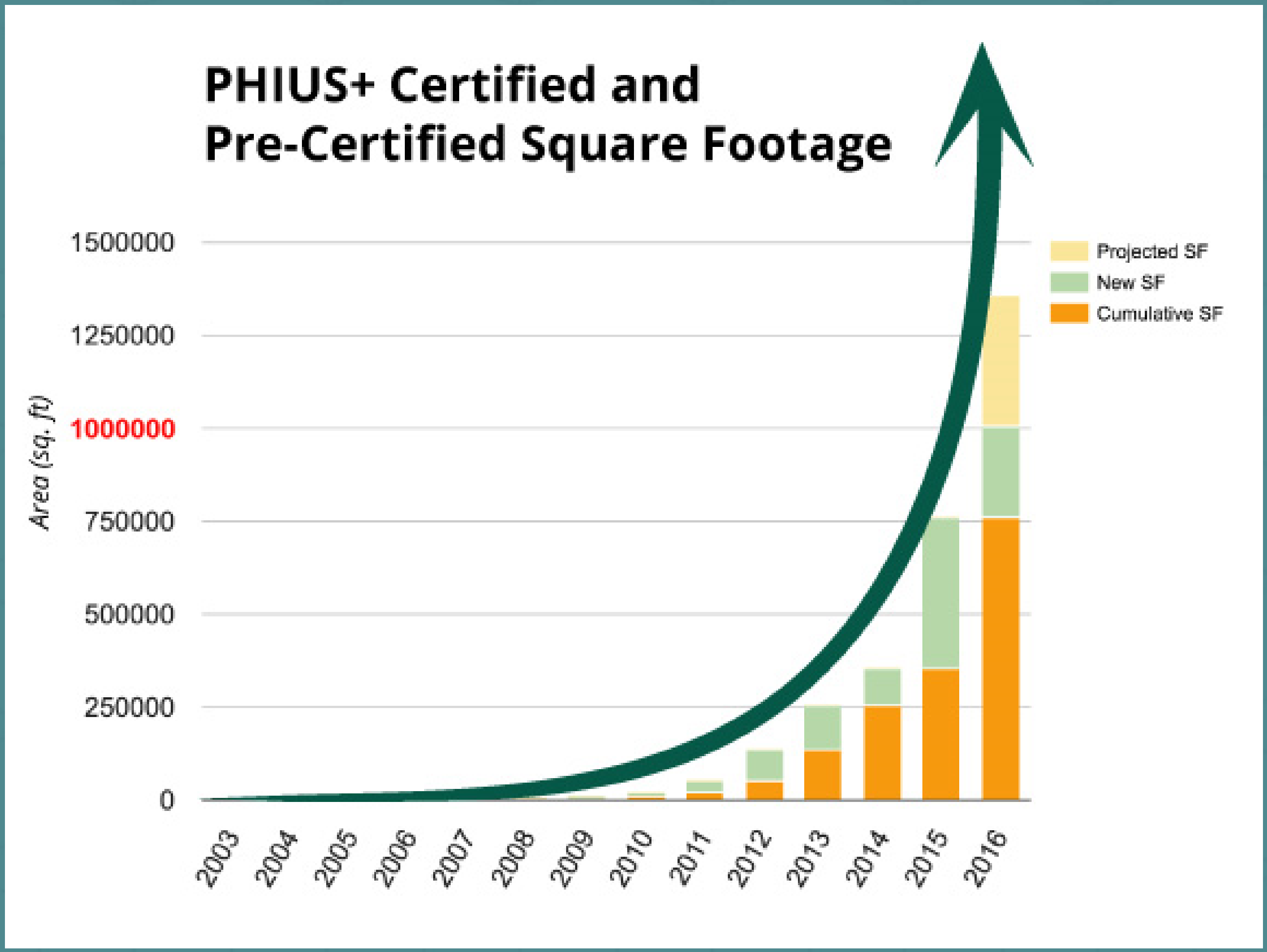
70+ MULTIFAMILY SUBMITTED, PRE-CERTIFIED, CERTIFIED

SITE EUIs OF 10-25 kBTU/ft².yr

~20-50% better than DOE's Zero Energy Home Program

~350+ PROJECTS IN NORTH AMERICA

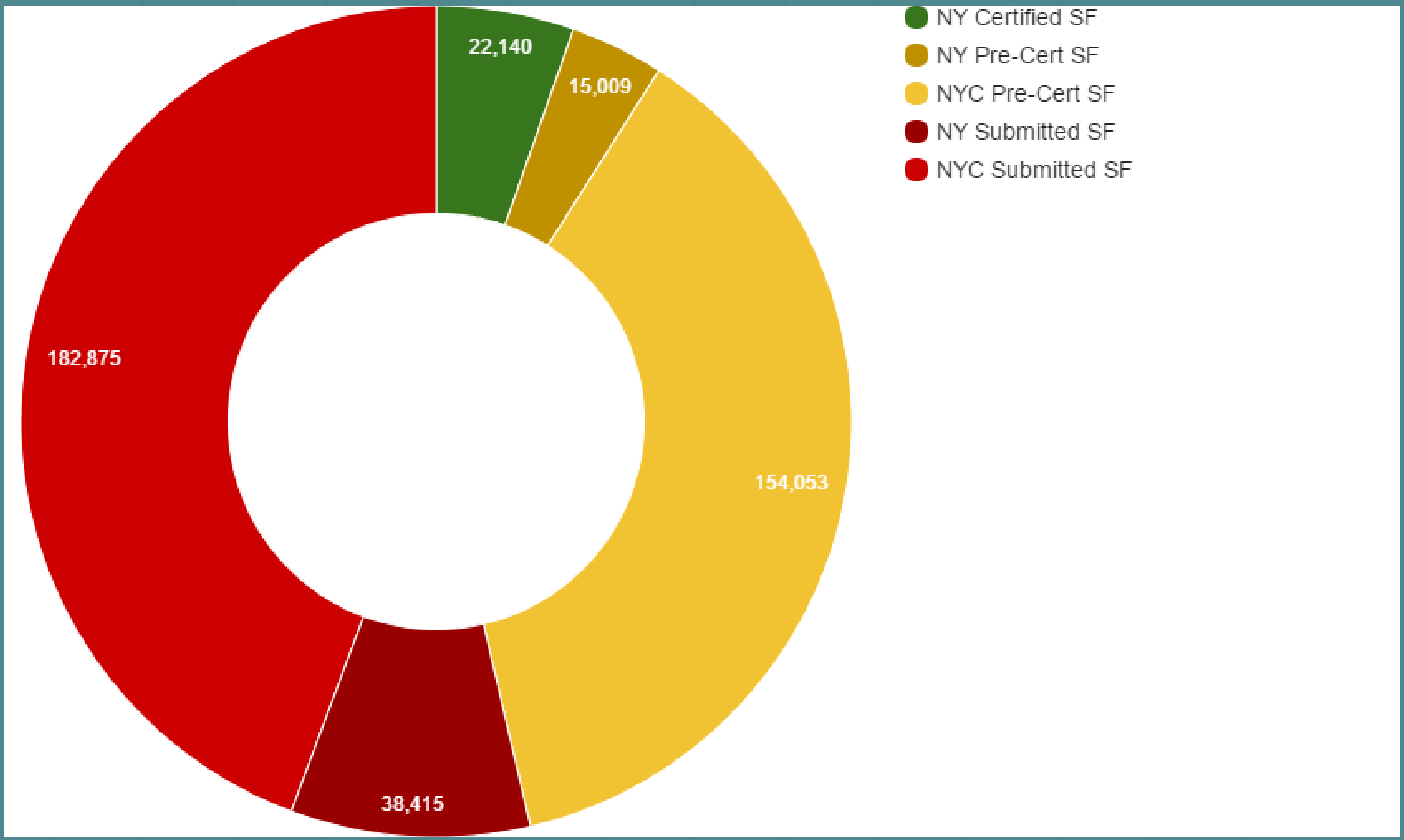
PASSIVE HOUSE US DATABASE



Source: www.phius.org

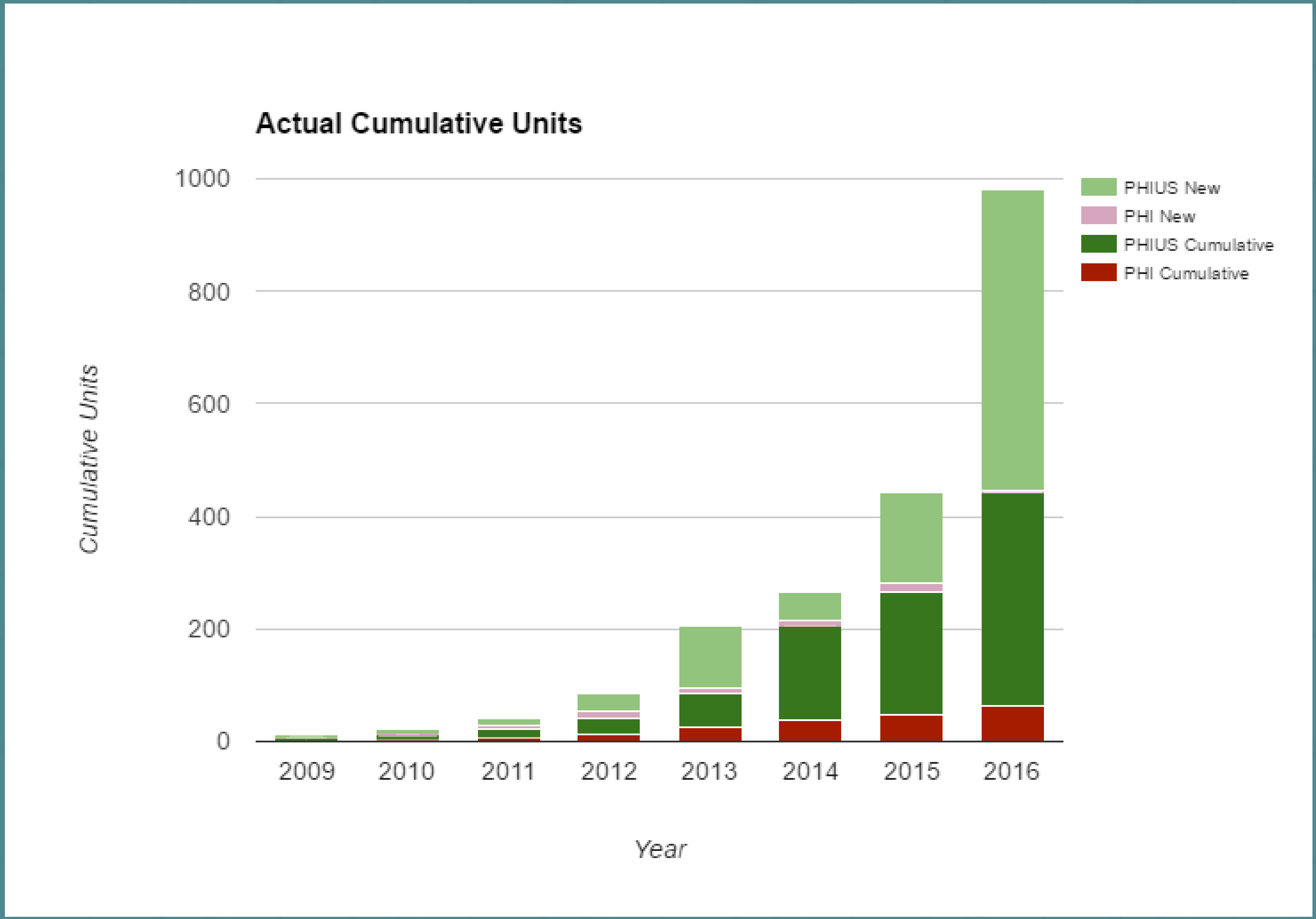
PHIUS CERTIFIED PROJECTS

NY STATE AND CITY SQFT
OCTOBER 2016 PHIUS+ PROJECTS



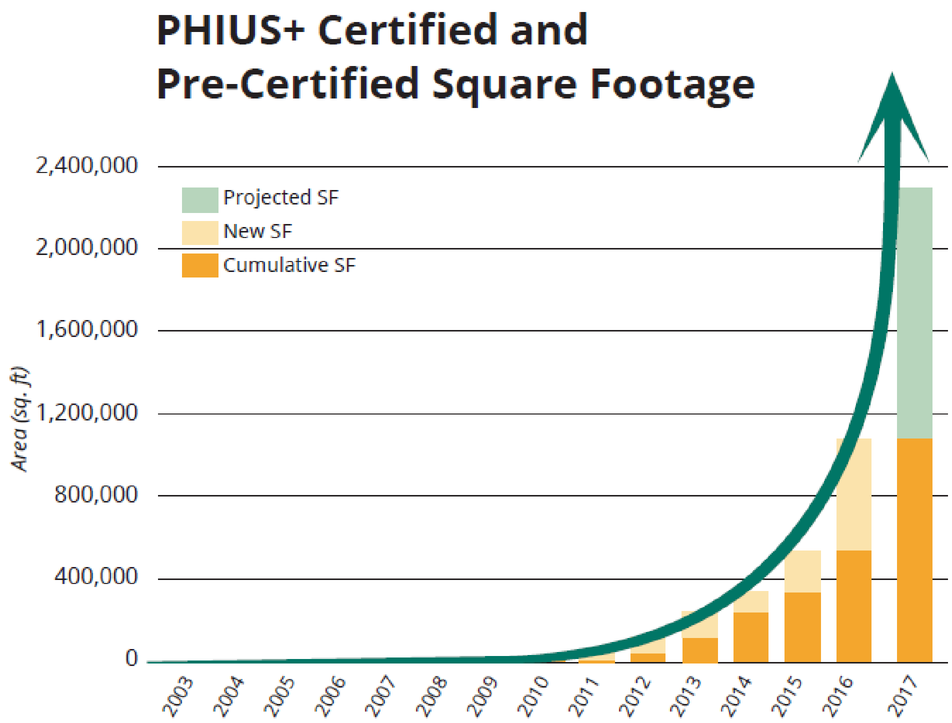
410,000 SQ FT TOTAL DOCUMENTED SUBMISSIONS

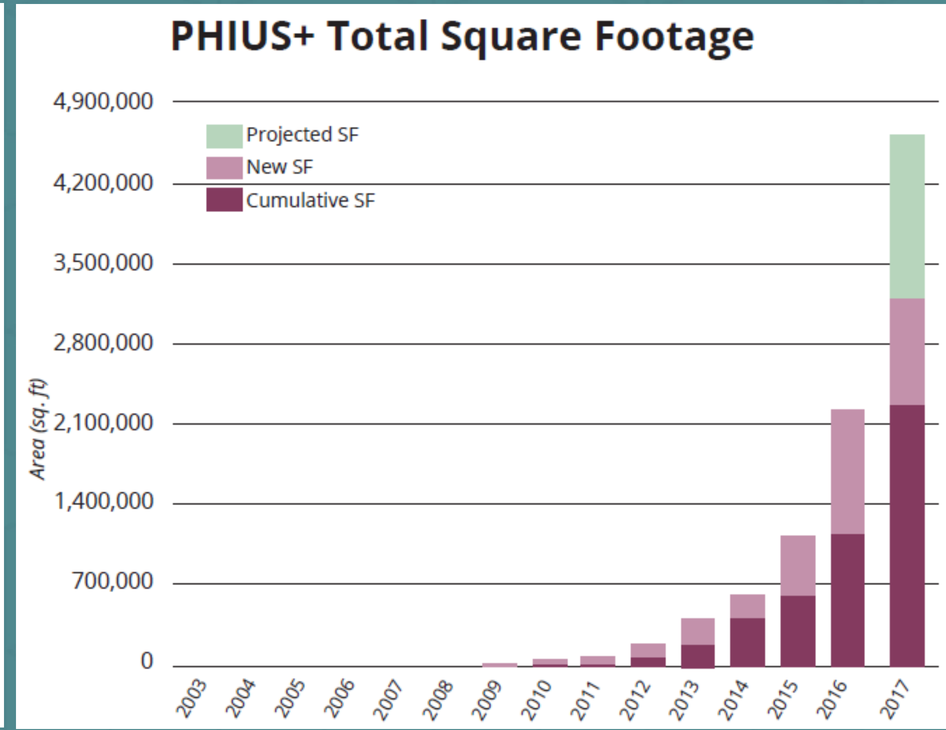
PHI AND PHIUS+ TRENDS IN NA:
CERTIFICATIONS BY END OF 2016



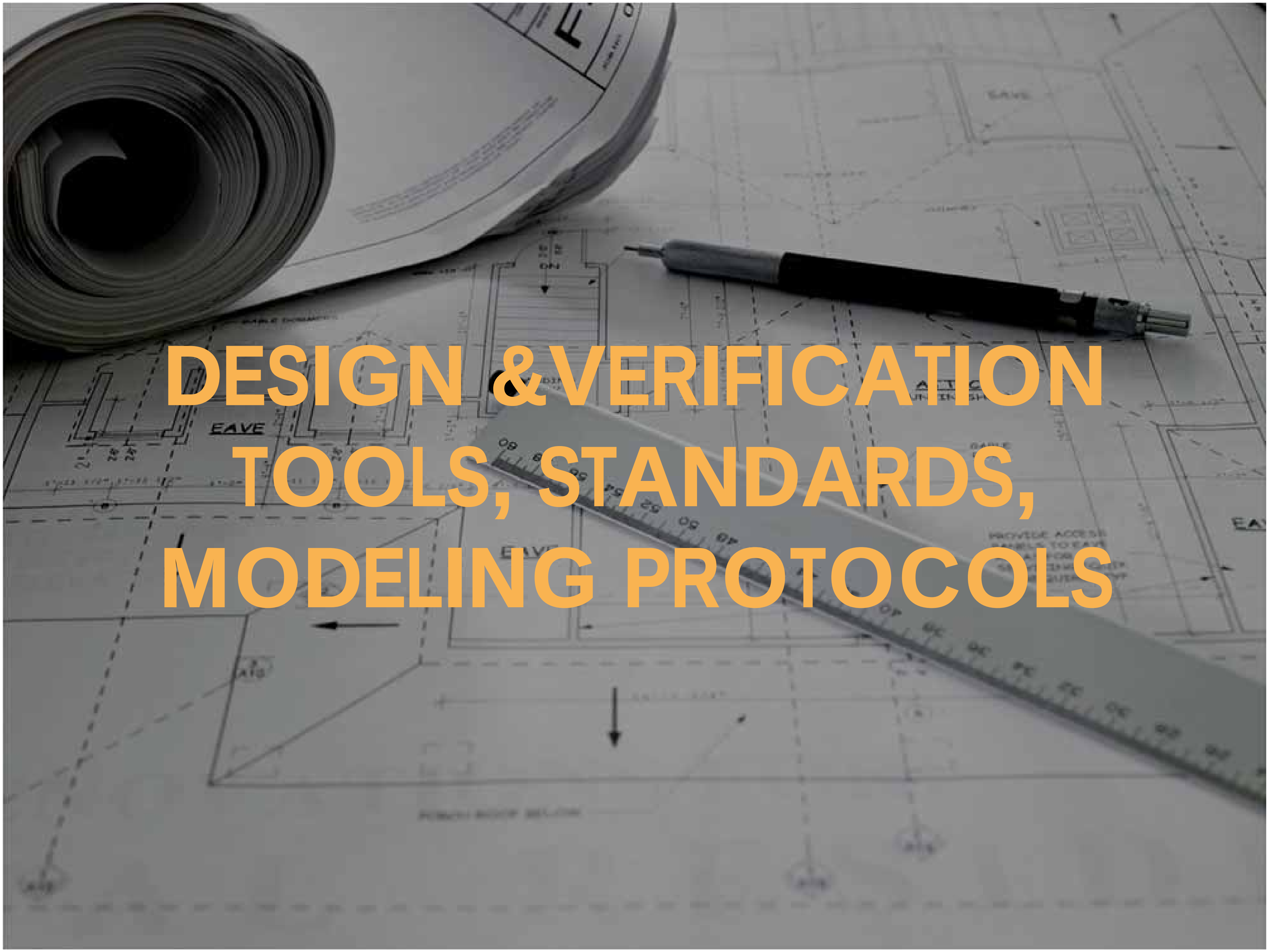
PHIUS+ TRENDS FOR 2017

Source: www.phius.org



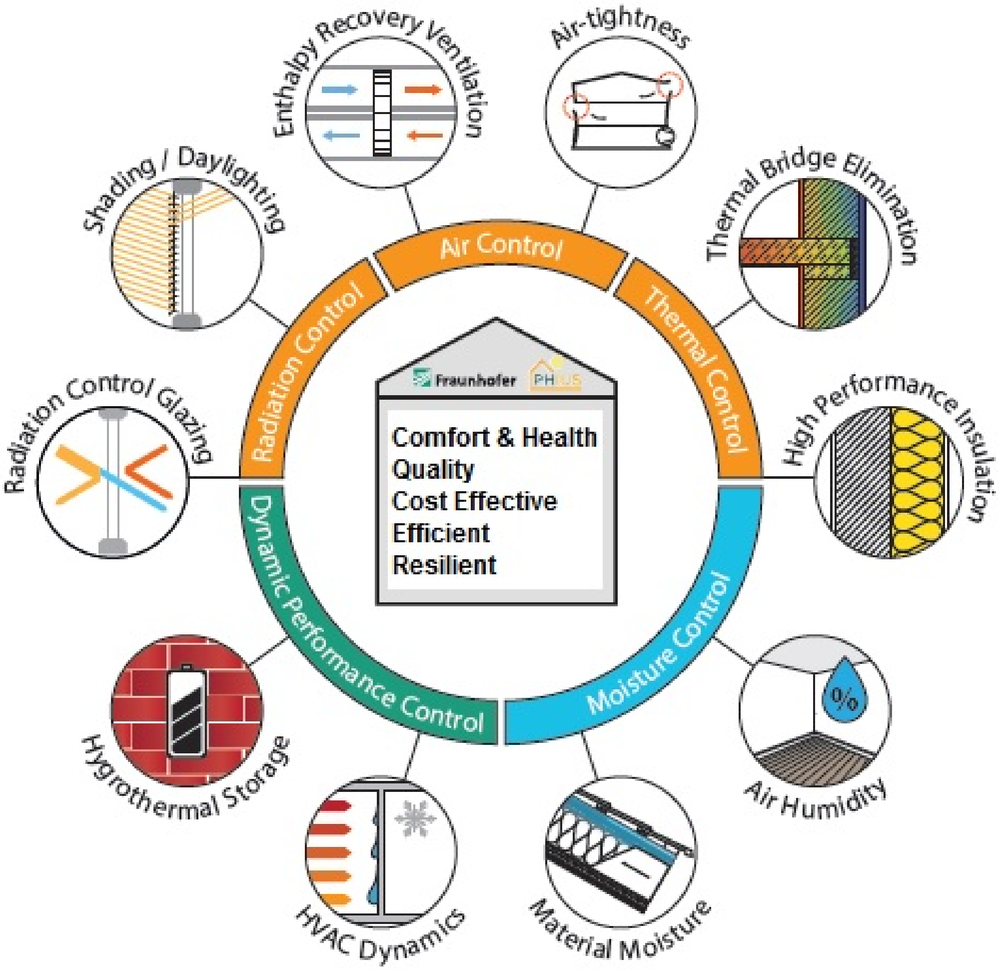


95% of total certified and pre-certified passive building construction (SQFT) in NA



DESIGN &VERIFICATION TOOLS, STANDARDS, MODELING PROTOCOLS

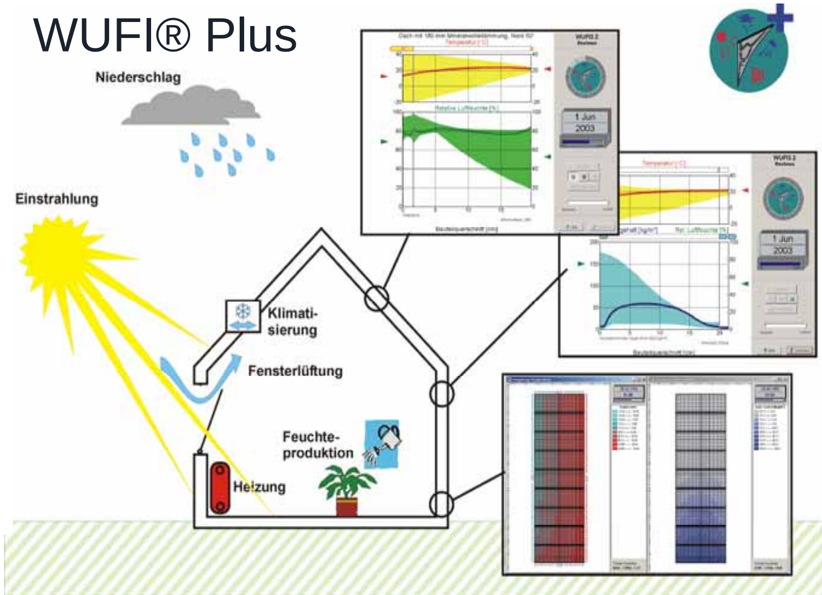
WHOLE BUILDING ENERGY BALANCE



WUFI® Passive

PHPP

WUFI® Plus



TERMINOLOGY

Demands, Peaks, Site & Primary Energy

Annual Demand [kBTU/yr.ft^2]: Space conditioning energy consumed over the course of the year, delivered by the equipment to the space.

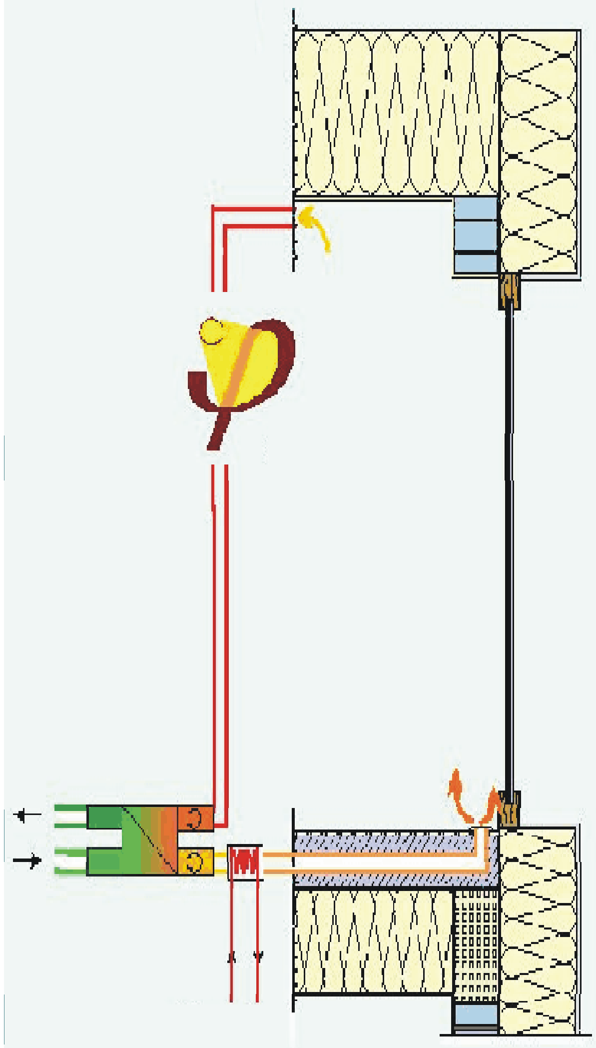
Peak Load [BTU/hr.ft^2]: Space conditioning requirement during the peak climate conditions (average over the worst 24 hours). Determines the size of the mechanical system.

Site Energy [kWh/person.yr] OR [kBTU/yr.ft^2]: Total energy consumed over the course of the year, including space conditioning, hot water, plug loads, lighting, appliances, systems, etc. (Excludes electrical vehicle charging energy, and ligthing energy specific to vehicle parking areas)

*No requirement for PHIUS+ Certification

Source (Primary) Energy [kWh/person.yr] OR [kBTU/yr.ft^2]:
Site energy as described above, multiplied by the source/primary energy factor for the specific fuel type used.
Ex: Electricity has a PE factor of 3.16 kWh/kWh (generation at the source vs use on site)

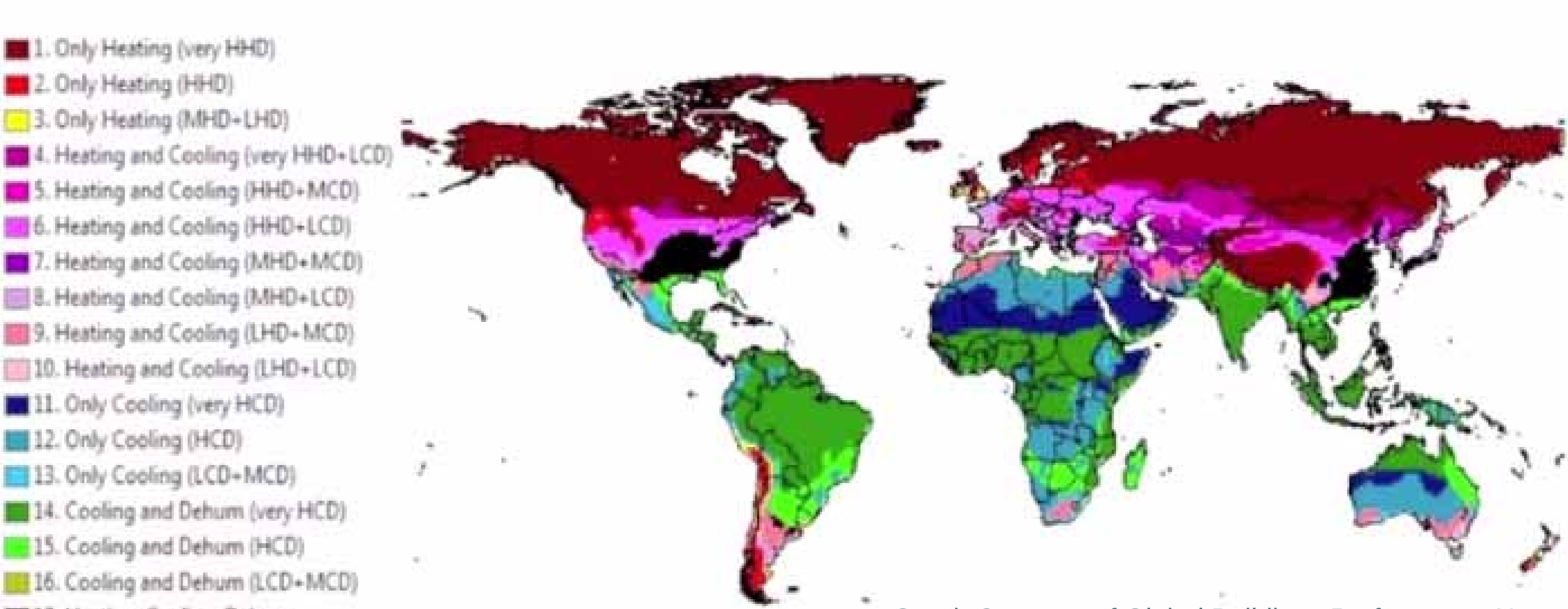
EUROPEAN PASSIVHAUS CRITERIA



Primary Energy	$kBTU/ft^2/yr$	38
Airtightness	ACH_{50}	0.6
Annual Heat Demand / Annual Cooling Demand	$kBTU/ft^2/yr$	4.75 (+ allowance for latent)
Peak Heat Load	$BTU/ft^2.hr$	3.14
Peak Cooling Load	$BTU/ft^2.hr$	2.54
Ventilation	% efficiency	75%
Ventilation	W/cfm	≤ 0.76
Thermal Envelope	$hr. ft^2 °F/BTU$	≥ R-38.5
Thermal Envelope	$BTU/hr. ft^2 °F$	≤ U-0.026
Thermal Bridge Free	BTU/ hr. ft °F	Ψ ≤ 0.006
Windows Installed	$BTU/hr. ft^2 °F$	Uw-install ≤ 0.15
SHGC	%	≈ 0.50 - 0.55

or

PHIUS+2015:
CLIMATE SPECIFIC DESIGN



Graph Courtesy of Global Buildings Performance Network

PHIUS+ 2015 PASSIVE BUILDING CRITERIA

Primary Energy	$kBTU/ft^2/yr$	(Bedrooms+1 * (6200 kWh *3.412 kBTU/kWh))/iCFA
Airtightness	cfm/ft^2	0.05 $cfm/gross\ ft^2$ shell @ 50 pa
		0.08 $cfm/gross\ ft^2$ shell @ 75 pa
Annual Heat Demand	$kBTU/ft^2/yr$	1.0 - 12.0
Annual Cooling Demand		1.0 - 21.4
AND		
Peak Heat Load	$BTU/ft^2.hr$	0.8 - 5.4
Peak Cooling Load		1.8 - 8.9
Ventilation	% efficiency	53% - 95%
	W/cfm	0.27 - 2.23
Thermal Envelope	$hr.\ ft^2 °F/BTU$	≈ R-25 - R-80
	$BTU/hr.\ ft^2\ °F$	≈ U-0.04 - U-0.0125
Thermal Bridge Free	BTU/ hr. ft °F	$\Psi \leq 0.006$
Windows Installed	$BTU/hr.\ ft^2\ °F$	Uw-install 0.41 - 0.08
SHGC	%	≈ 0.27 - 0.61

PHIUS+ 2015 COMMERCIAL PASSIVE BUILDING CRITERIA – SAME EXCEPT SOURCE ENERGY CRITERION: CHANGE TO PER AREA+PROCESS LOAD SPECIFIC CRITERION IF APPLICABLE

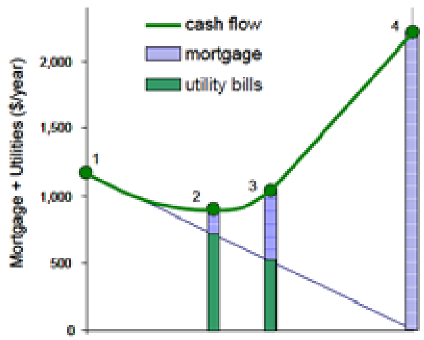
Primary Energy	kBTU/ft²/yr	38
Airtightness	cfm/ft²	0.05 cfm/gross ft² shell @ 50 pa
		0.08 cfm/gross ft² shell @ 75 pa
Annual Heat Demand	kBTU/ft²/yr	1.0 - 12.0
Annual Cooling Demand		1.0 - 21.4
	AND	
Peak Heat Load	BTU/ft².hr	0.8 - 5.4
Peak Cooling Load		1.8 - 8.9

Ventilation	% efficiency	53% - 95%
	W/cfm	0.27 - 2.23
Thermal Envelope	hr. ft²°F/BTU	≈ R-25 - R-80
	BTU/hr. ft² °F	≈ U-0.04 - U-0.0125
Thermal Bridge Free	BTU/ hr. ft °F	Ψ ≤ 0.006
Windows Installed	BTU/hr. ft² °F	Uw-install 0.41 - 0.08
SHGC	%	≈ 0.27 - 0.61

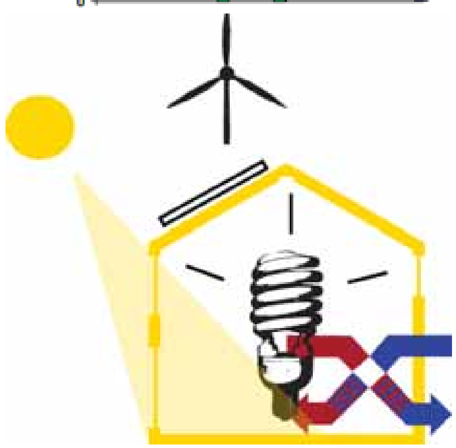
METHODOLOGY

Climate Specific & Cost Optimal Standards

Developed by US Industry



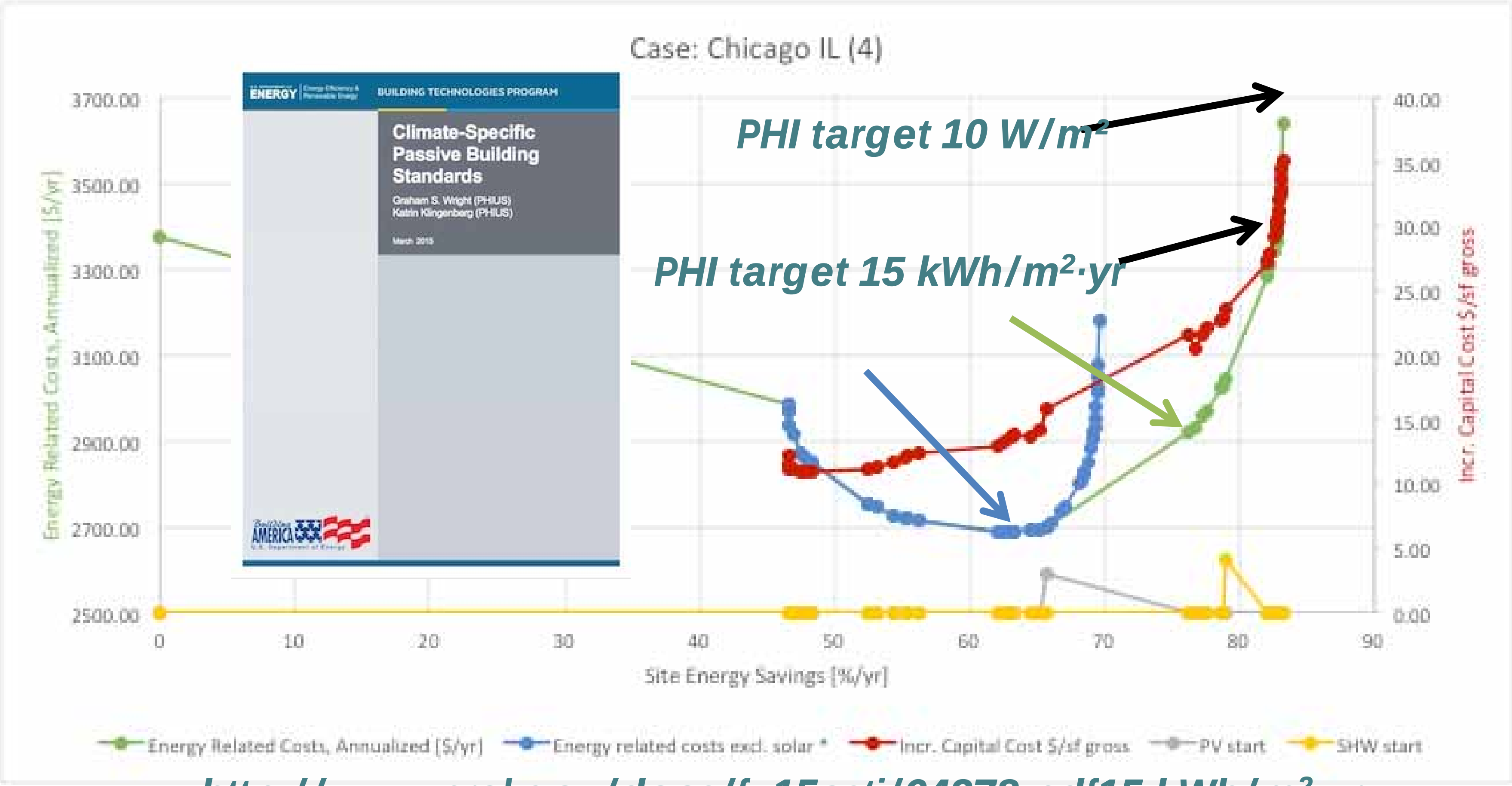
NREL BEopt optimizes upgrade package by climate



Standards defined as cost optimal/competitive sweetspot between conservation and generation

on the path to zero

NEW STANDARDS IDENTIFY US **ECONOMIC** OPTIMUM TAKING PV COST INTO ACCOUNT



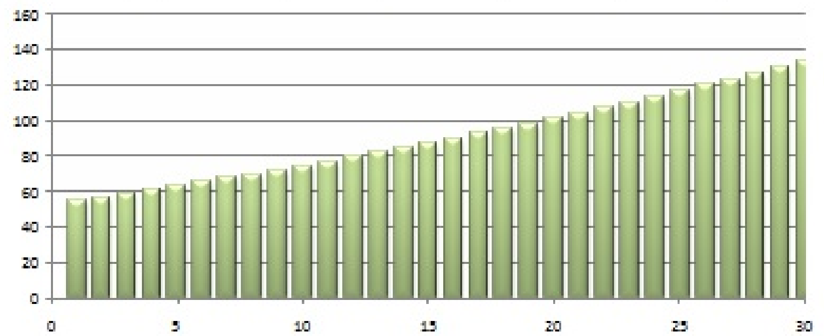
http://www.nrel.gov/docs/fy15osti/64278.pdf15 kWh/m²·yr

EXAMPLE DASHBOARD CALCULATOR

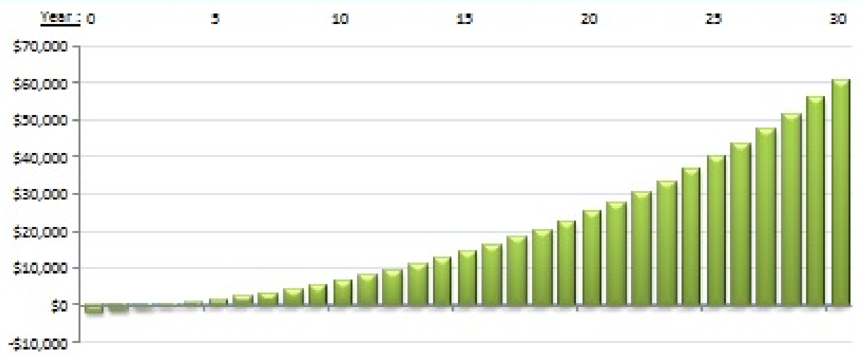
Cost of Home Options	Cost of Baseline Home	Upgrade to Passive House *	Cost of Passive House
	338,800	3%	349,500

Energy Cost, Baseline Home ($ per month)	150
Annual Rate of increase in Energy Costs Projected	2%
Energy Reduction from Passive House Approach (%)	68%

Energy savings available EACH MONTH, after covering the monthly payment related to upgrades.



Future Value of Energy Savings Applied to Extra Down Payment

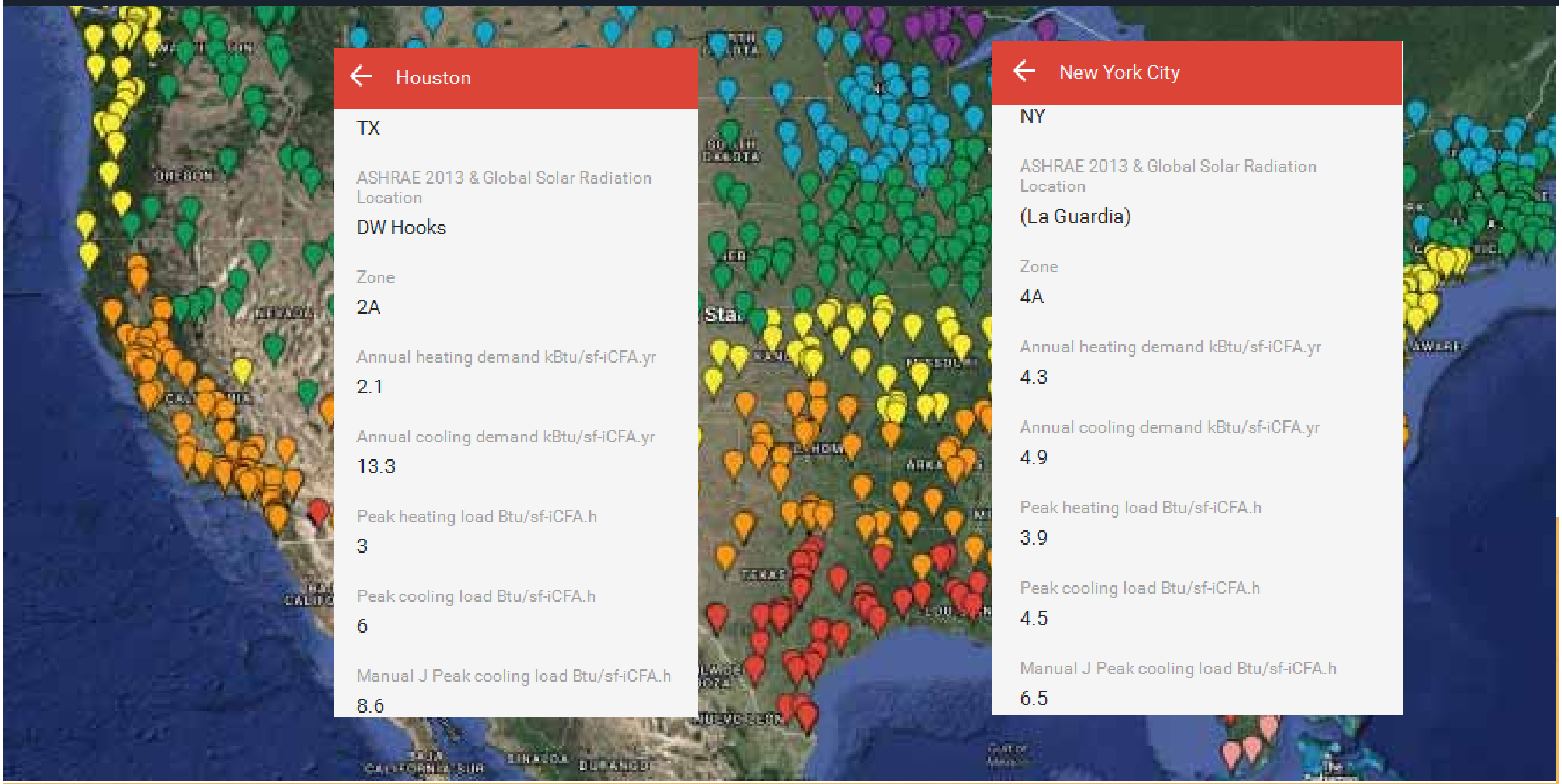


Costs to Upgrade to Passive House			
Added Costs of Improving Thermal Performance of Home:			
Baseline Cost:	Item:	Percent	$
	increase in cost of framing labor		0
	increase in cost of framing materials		0
	increase in cost of window units		7,500
	increase in cost of insulated doors		0
	increase in cost of insulation, labor and materials		9,200
			0
Energy Recovery Ventilation system, increased cost as compared to the sum of the cost of all typical ventilation systems			4,000
Electric resistance coil heating source, one of many approaches to heating a Passive House. Remember, the heating load will be around 10% of the heating load of a typical home.			2,000
Typical heating system that is not needed and therfore represents money s			-12,000
* Total Costs to Upgrade to Passive House			10,700

INFORMATION PRESENTED BY:

CLIMATE SPECIFIC METRICS

PASSIVE STANDARDS IN VARYING CLIMATES



PERFORMANCE CRITERIA DIFFERENCES

Annual Demand, Peak, Source & Air-tightness

PHI CERTIFICATION – does not require US industry standards

- One annual demand target for space conditioning for all climates with an additional allowance for dehumidification based on climate
- Targets not cost-optimized by location
- No mandatory climate specific peak load target to assure thermal comfort
- Source energy target per square foot for residential and commercial & PER based on German conversion factors
- Air-tightness measured relative to building volume
- Standard applied to residential and commercial, separate & less stringent standard for retrofit projects

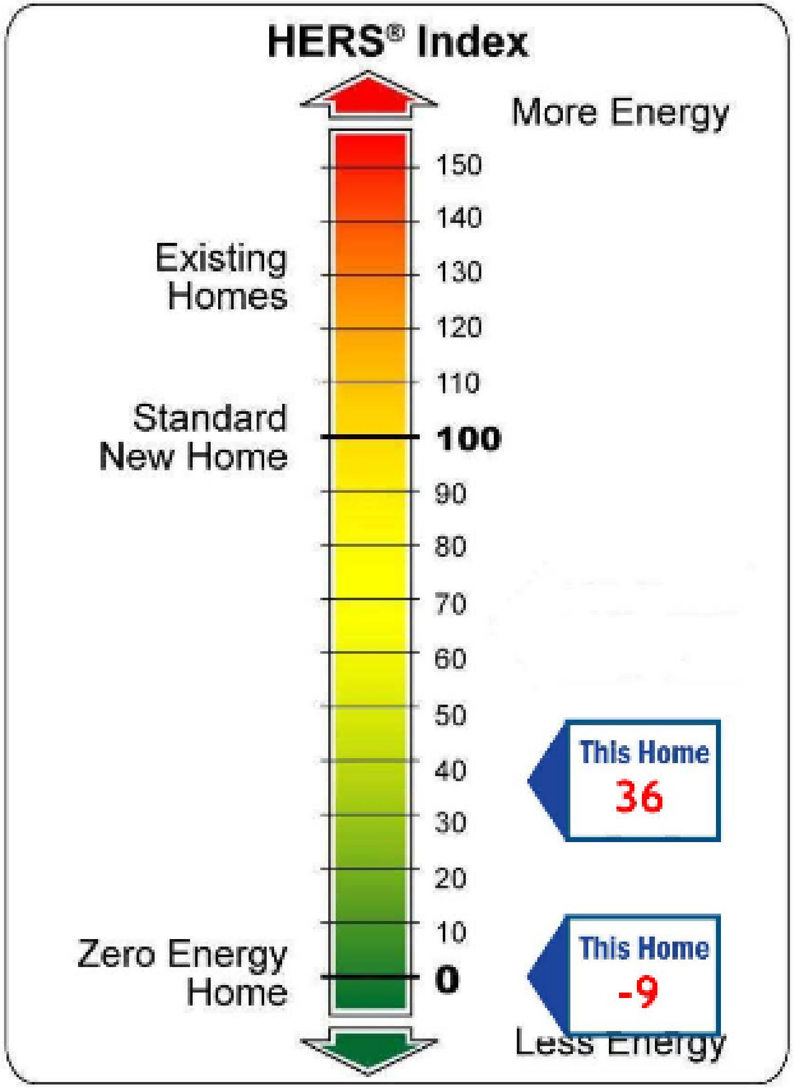
PHIUS+2015 – requires US industry standards (DOE ZERH, ES, Indoor AIR Plus)

- Climate specific annual demand targets for all space conditioning
- Targets cost-optimized by location
- Mandatory peak load targets to assure thermal performance & resilience
- Source energy target per person for residential, square foot for commercial based on US conversion factors
- Air-tightness measured relative to opaque envelope area
- Standard applied to all building types including retrofits with an additional allowance for existing thermal bridging

DOE PERFORMANCE STAIRCASE

IECC 2009	IECC 2012	ENERGY STAR v3	ENERGY STAR v3.1	ZERH	PHIUS+	PHIUS+ SourceZero
						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. & H_2O Distrib	Eff. Comps. & H_2O Distrib	Eff. Comps. & H_2O Distrib
				EPA Indoor Air Pacakge	EPA Indoor Air Pacakge	EPA Indoor Air Pacakge
				Ducts in Condit. Space	Ducts in Condit. Space	Ducts in Condit. Space
		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
		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.	Ultra-Efficient Enclosure	Ultra-Efficient Enclosure
HERS 85-90	HERS 70-80	HERS 65-75	HERS 55-65	HERS 48-55	HERS 35-45	HERS < 0

COOPERATION WITH ZERH YIELDS HERS



Source: http://energy.gov/sites/prod/files/2016/04/f30/Green%20Future_Presentation_2016.pdf

CERTIFICATION PROTOCOL DIFFERENCES

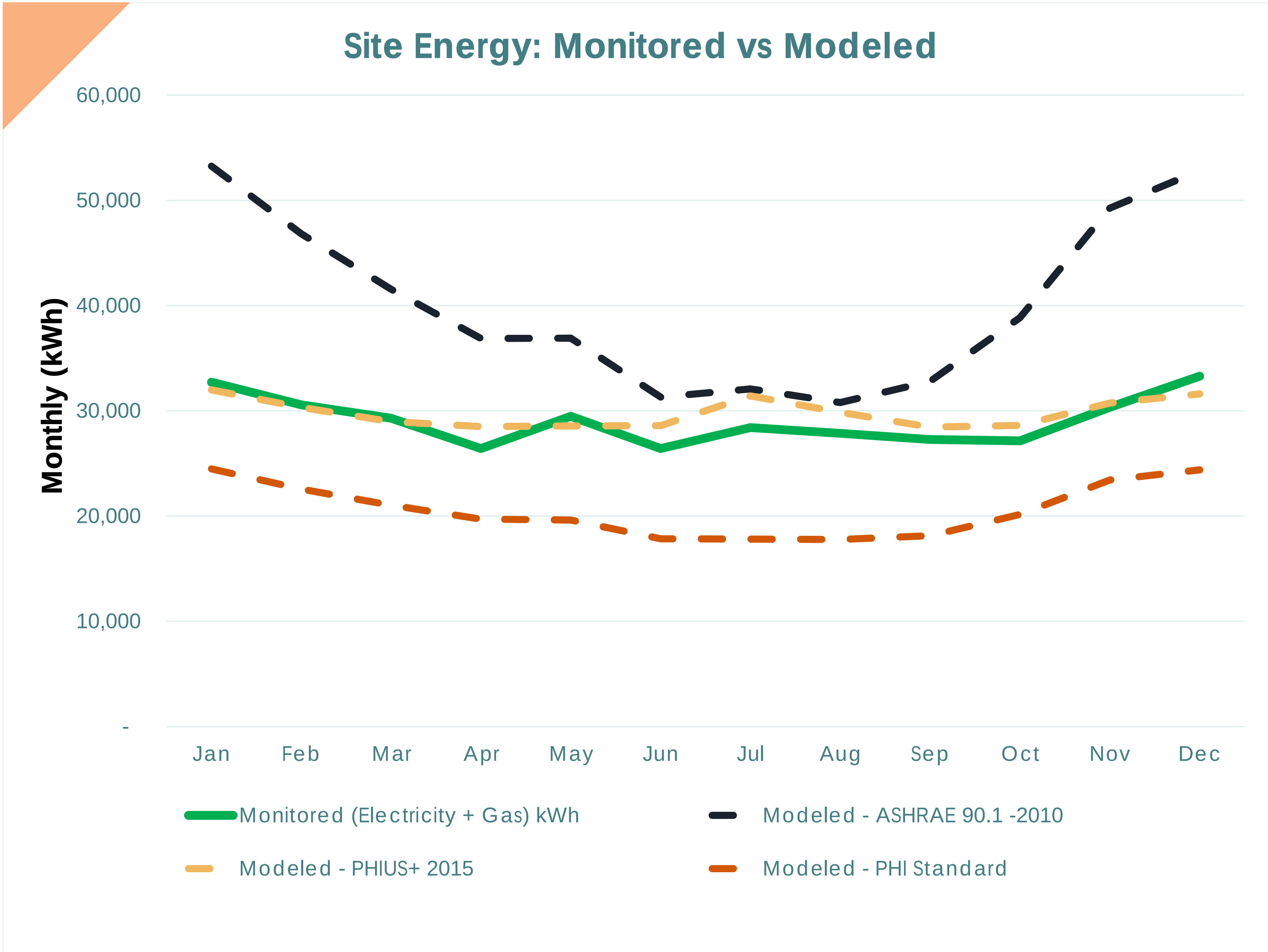
Internal Gains, TFA and iCFA, Occupancy & MELs

PHI –

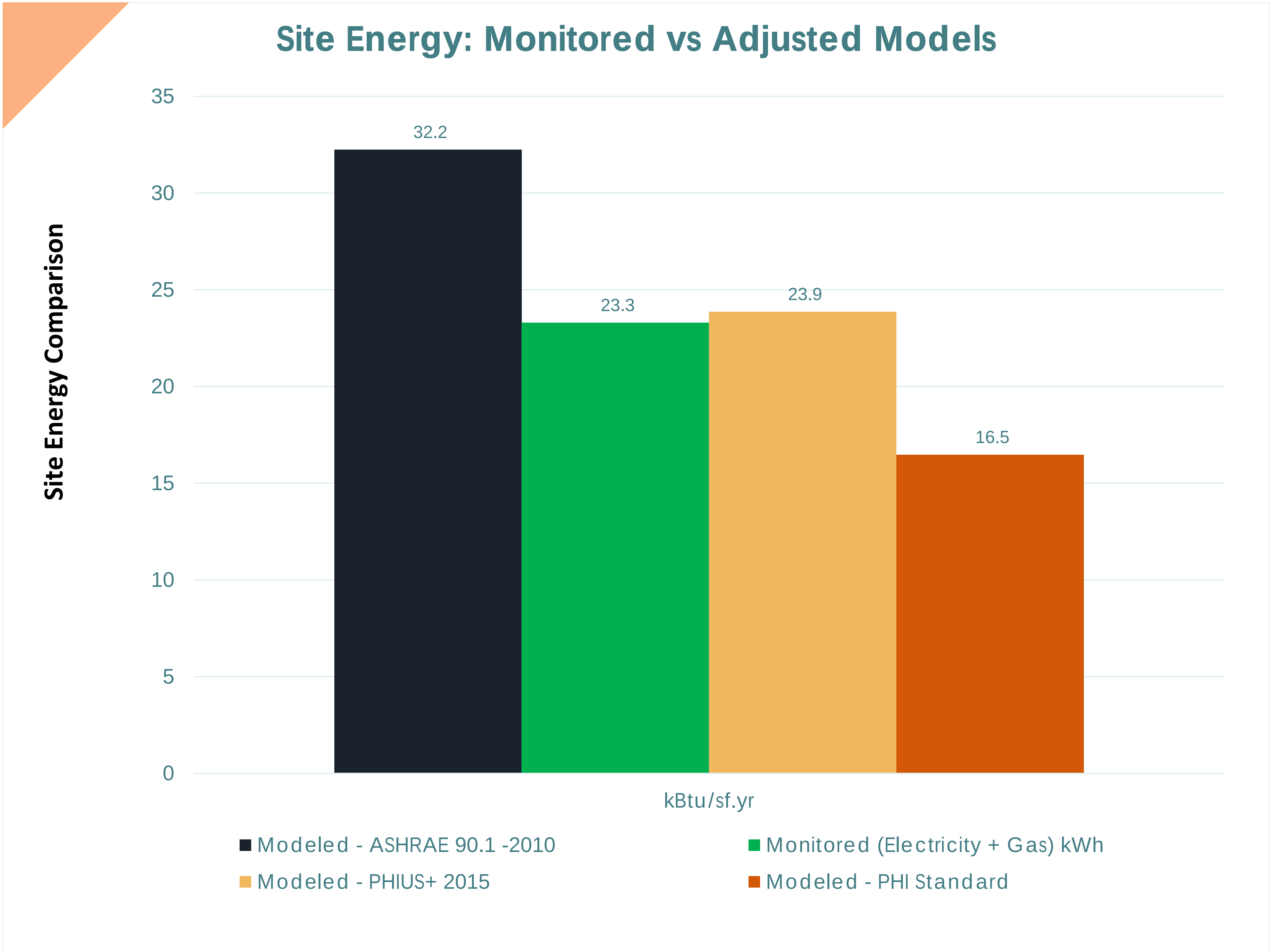
- Unrealistically low internal gain default assumptions
- Treated Floor Area (TFA) energy reference area – *EUIs are not directly comparable!*
- Occupancy assumption by fixed square foot per person
- Different MEL and lighting assumptions
- Source EUI – based on German conversion factors – *not directly comparable!*

PHIUS+2015 –

- 80% of RESNET internal gain assumptions
- Interior conditioned floor area (iCFA) energy reference area – *EUIs are not directly comparable!*
- Occupancy calculated bedrooms +1
- Different MEL and lighting assumptions
- Source EUI – based on US conversion factors – *not directly comparable!*

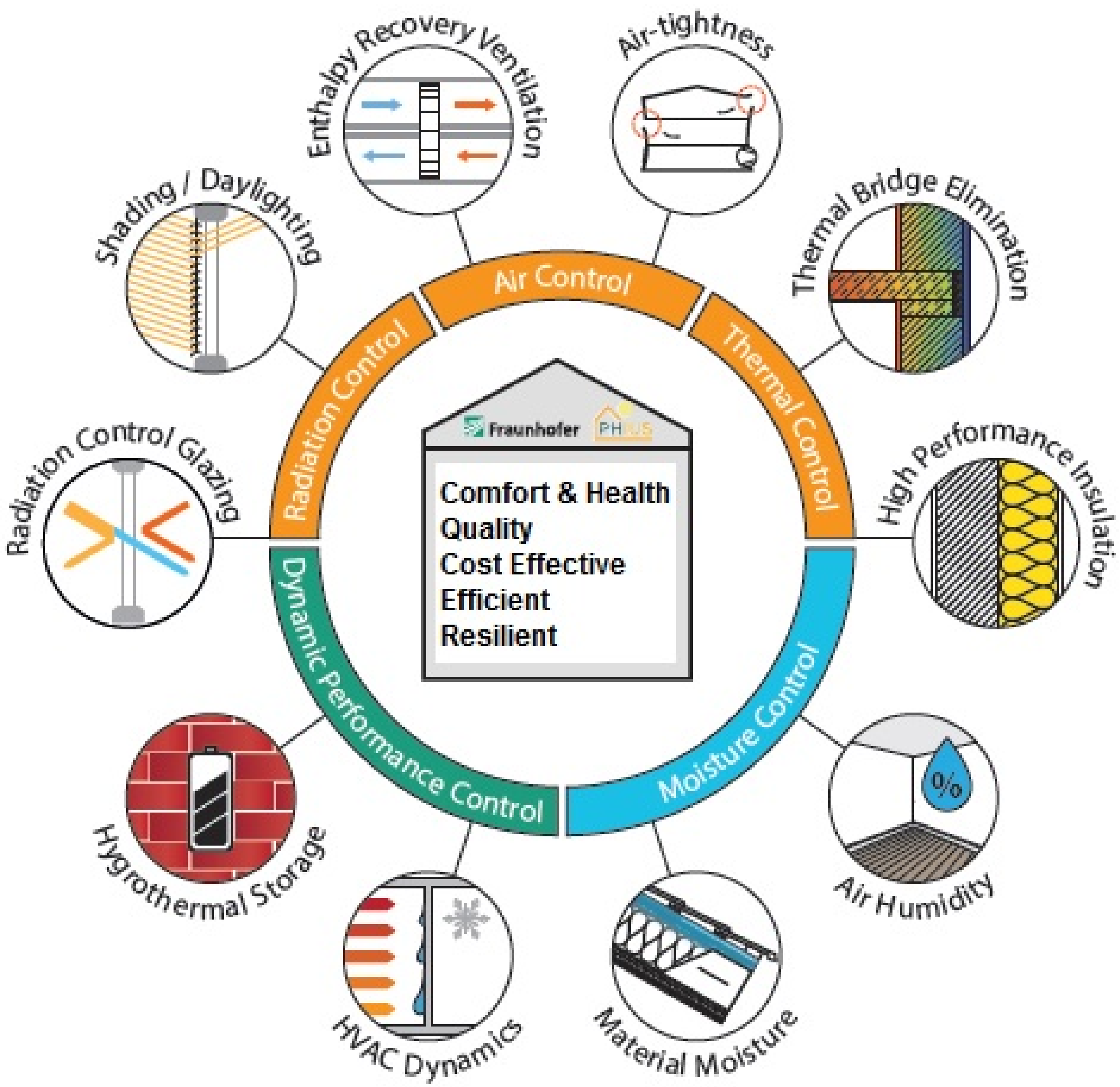


Site Energy: Monitored vs Modeled
Monthly (kWh)
60,000
50,000
40,000
30,000
20,000
10,000
-
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monitored (Electricity + Gas) kWh
Modeled - ASHRAE 90.1 -2010
Modeled - PHIUS+ 2015
Modeled - PHI Standard

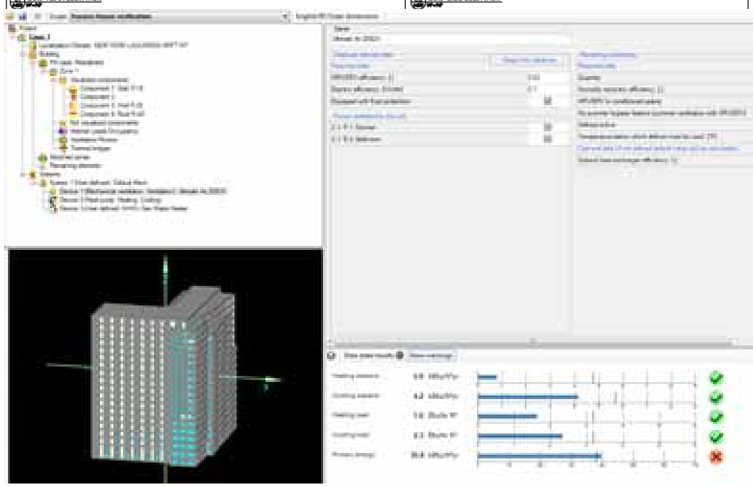

Site Energy: Monitored vs Adjusted Models
Site Energy Comparison
35
30
25
20
15
10
5
0
32.2
23.3
23.9
16.5
kBtu/sf.yr
Modeled - ASHRAE 90.1 -2010
Monitored (Electricity + Gas) kWh
Modeled - PHIUS+ 2015
Modeled - PHI Standard

BASIC PASSIVE BUILDING PRINCIPLES

PASSIVE BUILDING PRINCIPLES



MULTIFAMILY HAS BETTER **SURFACE TO VOLUME** RATIO THAN SMALLER STRUCTURES



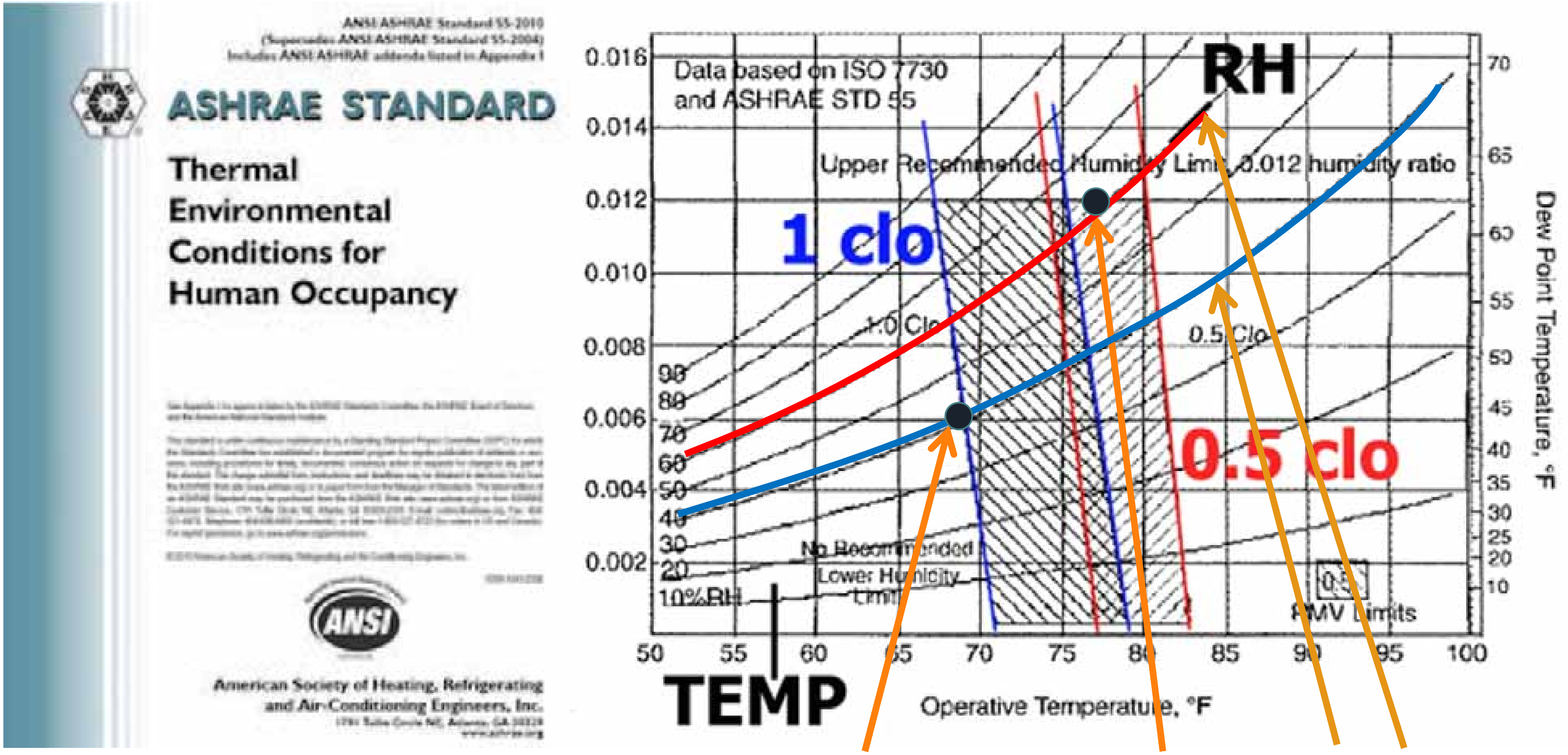
Single Family Home Specs:

- R-50 WALLS
- R-90 ROOF
- R-50 SLAB
- R-8 WINDOWS

Large Multifamily Specs:

- R-32 WALLS
- R-50 ROOF
- R-20 SLAB
- R-5 WINDOWS

PH THERMAL COMFORT RANGE



Interior comfort conditions winter 68 º F, summer 77 º F, RH 40-60%

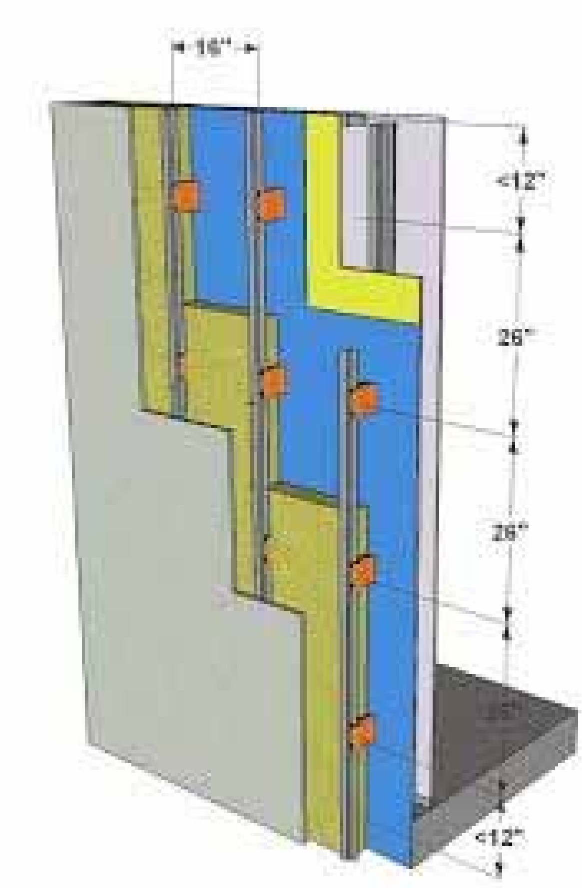
Source: ASHRAE Standard 55-2010 Thermal Environmental Conditions for Human Occupancy

CONTINUOUS INSULATION

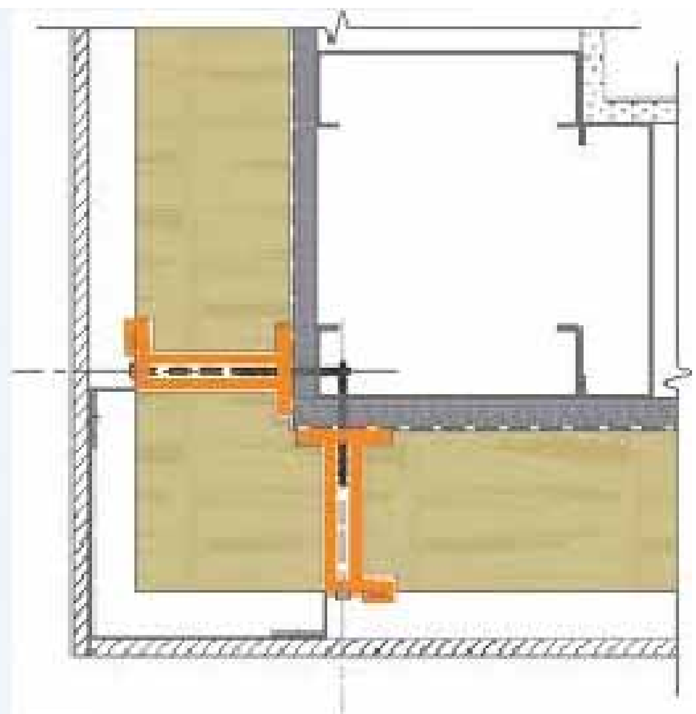
INSULATED CONCRETE FORMS

 |

THERMAL BREAKS



Cascadia Clip® system



MINIMIZE POINT TB LOSS

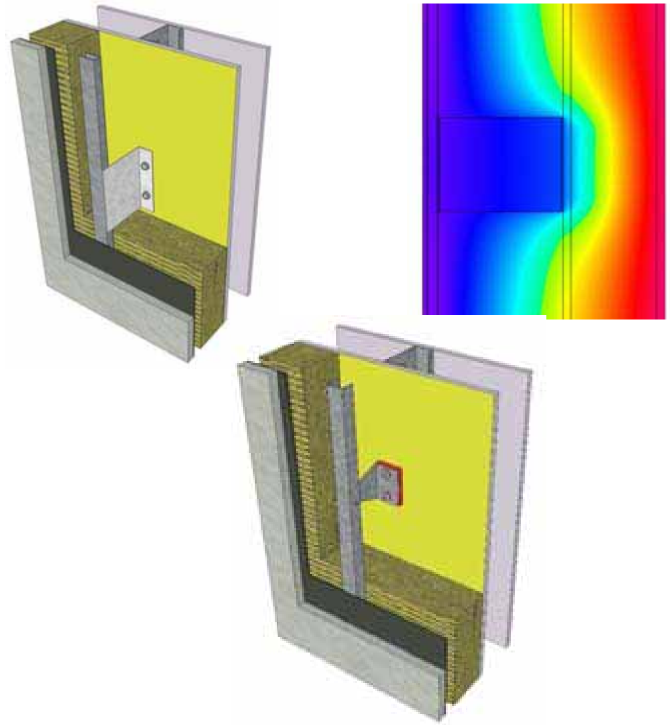


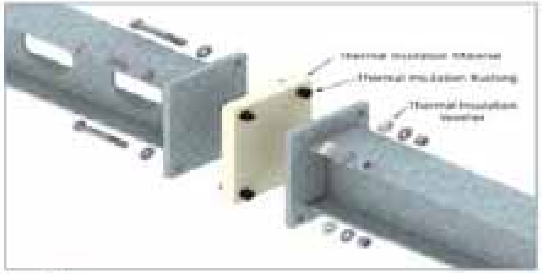
Photo courtesy Jesse Thompson

Illustrations by RDH, Shawn Colin, NAPHC 2014

STRUCTURAL THERMAL BRIDGING CAUSED BY CLADDING SYSTEMS ATTACHMENT – RED SPACER BEHIND STAND-OFF=THERMAL BREAK

UPTOWN LOFTS STRUCTURAL THERMAL BRIDGE ISSUE: SEPARATION TO UNCONDITIONED PARKING DECK

Mechanical Properties			
Tensile Strength	PSI	ASTM D638	9,400
Flexural Strength	PSI	ASTM D790	22,300
Compressive Strength	PSI	ASTM D695	38,900
Compressive Modulus	PSI	ASTM D695	1,450,377
Shear Strength	PSI	ASTM D732	13,400
Thickness	in	-	1/4", 1/2", 1"
Flame Resistance			
Oxygen Index	$\%O_2$	ASTM D2863	21.8
Thermal Properties			
Coefficient of Thermal Expansion	in/in/°Cx10⁻⁵	ASTM D696	2.2
Thermal Conductivity	BTU/Hr/ft²/in/°F W/m*K	ASTM C177	1.8** 0.259
** Reference: Thermal Conductivity of Steel	BTU/Hr/ft²/in/°F W/m*K		374.5 54.0



Additional Products for Building & Construction

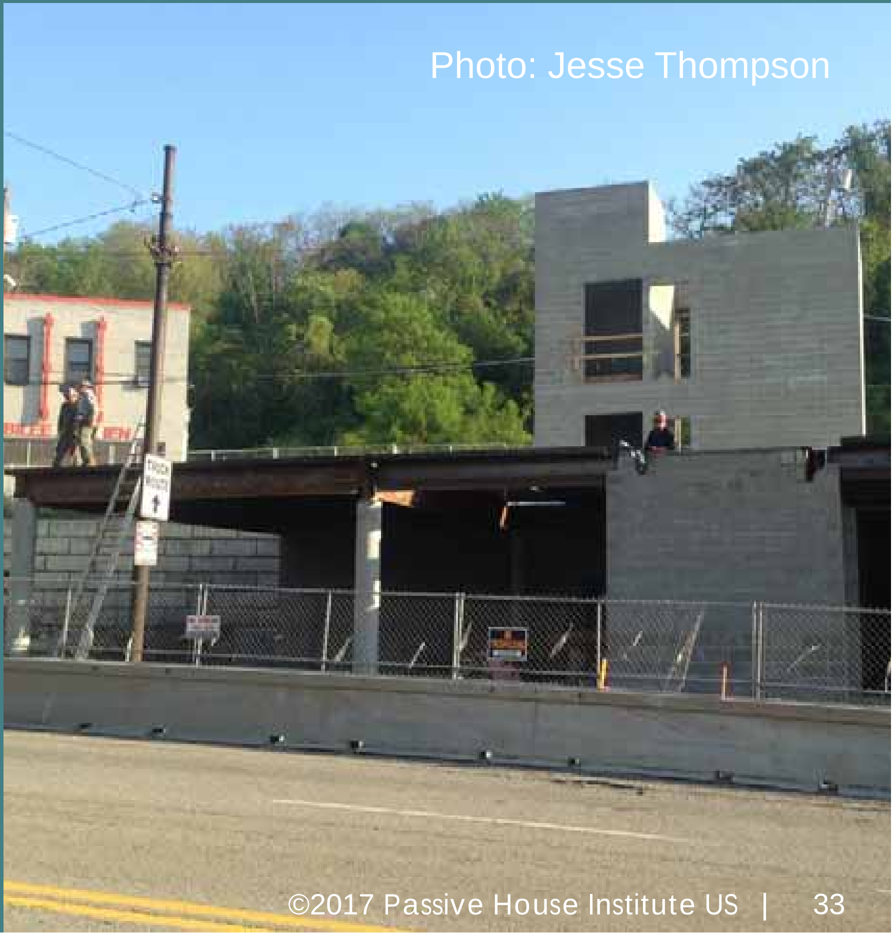
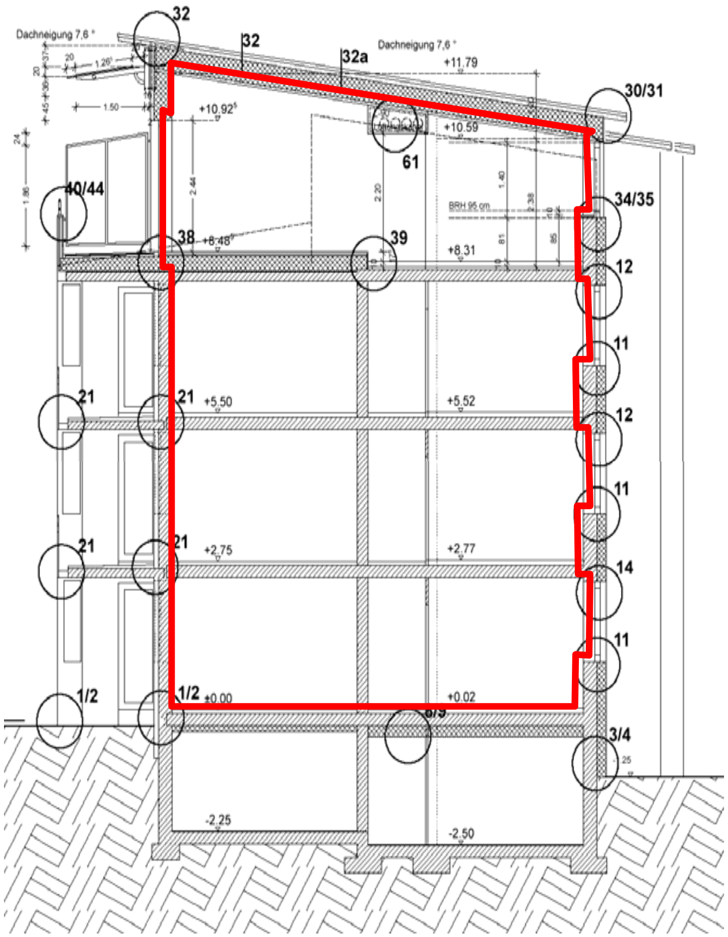


Photo: Jesse Thompson

AIR-TIGHTNESS **BENEFITS**

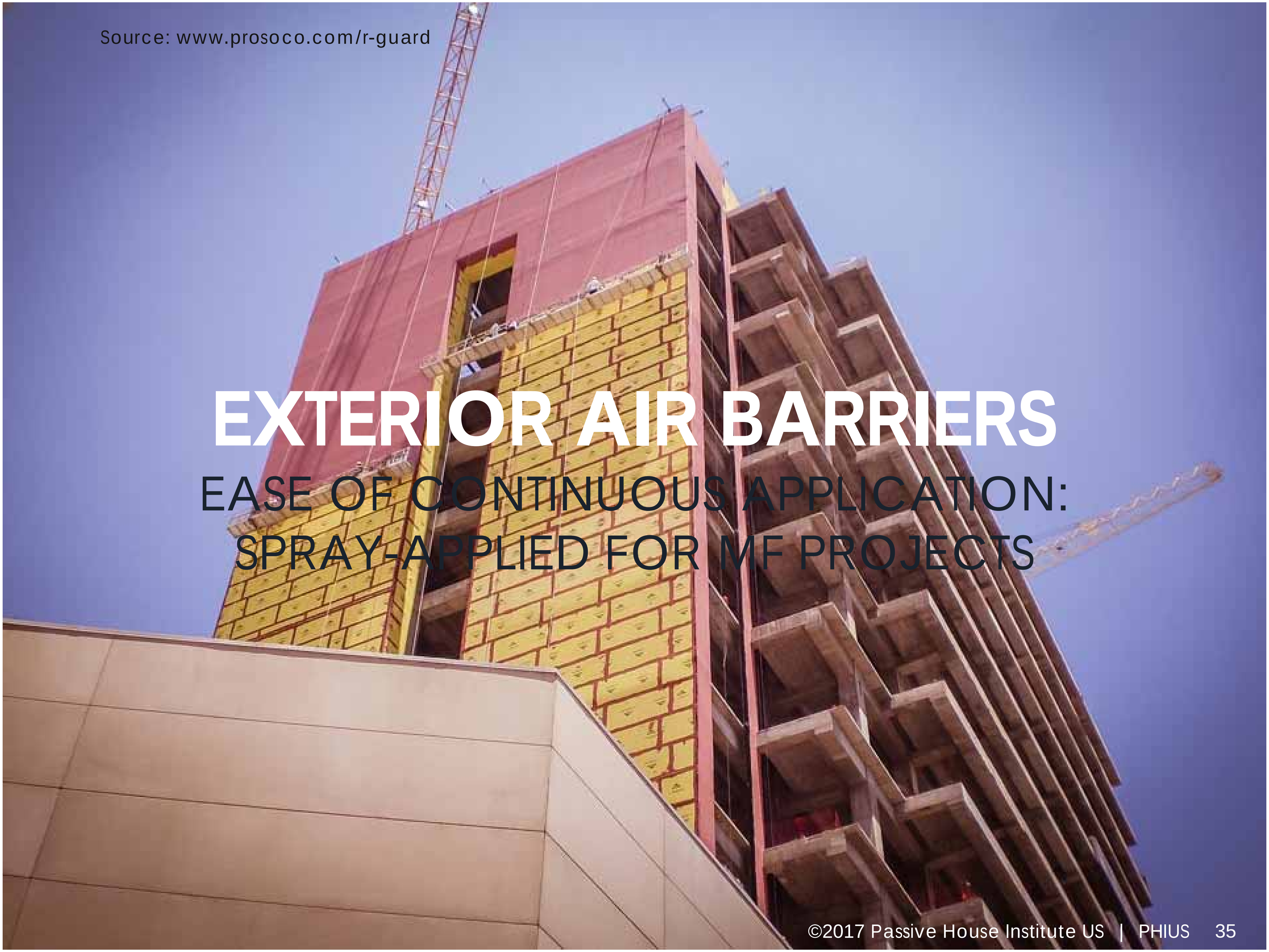


Energy benefits:

- Minimizes energy losses in conjunction with ventilation
- Minimizes latent loads in conjunction with ventilation

Hygrothermal benefits:

- Minimizes moisture traveling into the wall through infiltration or exfiltration
- Minimizes condensation risk in components
- Increases durability of assemblies



Source: www.prosoco.com/r-guard

EXTERIOR AIR BARRIERS

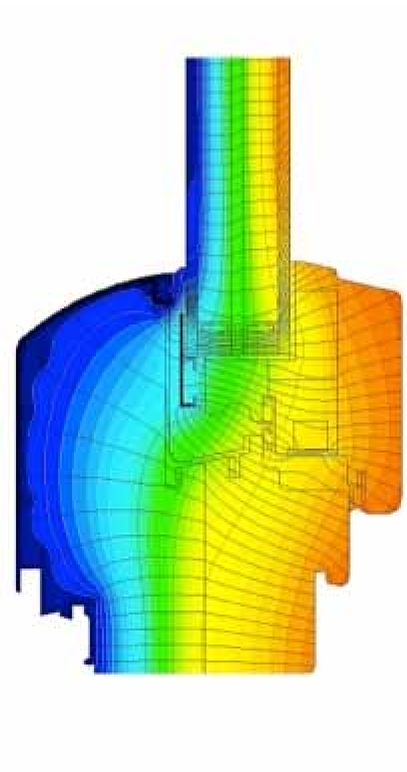
EASE OF CONTINUOUS APPLICATION: SPRAY-APPLIED FOR MF PROJECTS

HIGH PERFORMANCE WINDOWS

FOR BETTER COMFORT

IMPROVING WINDOW PERFORMANCE
MINIMIZES HEAT LOSS/GAIN, ASSURES THERMAL COMFORT,
ELIMINATES CONDENSATION

DIALING IN WINDOW PERFORMANCE BY CLIMATE



Product name:	Alpen Casement 073					Center-of-glass properties		
ASHRAE/IECC /DOE North American Climate Zone	South-facing	North, East, West - facing				Alpen _073		
			Whole-window installed U-value			Ucog-Value		
Climate specific recommendations:			W/m2K	BTU/hr.ft2.F	SHGC	W/m2K	BTU/hr.ft2.F	
8			0.82	0.14	0.469	0.478	0.084	
7			0.82	0.15	0.469	0.482	0.085	
6			0.83	0.15	0.469	0.489	0.086	
5			0.83	0.15				
4			0.83	0.15				
Marine North			0.84	0.15				
Marine South	✓		0.84	0.15				
3	✓		0.84	0.15				
2 West			0.83	0.15				
2 East			0.83	0.15				

PHIUS Passive House Institute US

Alpen Casement 073	FRAME		
	Frame height		U-fra
	mm	in	W/m2K
Head	72	2.82	1.12
Sill	72	2.82	1.12
Left	72	2.82	1.12
Right	72	2.82	1.12

Valid through February 2016

Find & Compare Windows

PHIUS Certified Data for Windows : PHIUS Certified Window Data for Designers & Builders

Available manufacturers:

Alpen
Cold Chain
HH
Intus
Kolbe
Marvin
Thermotech
Veka
Wasco
Zola

Frame Material (FM)
FG - Fiberglass
VL - Vinyl
WD - Wood
PC - Unplasticized Polyvinyl Chloride (uPVC)
Al - Aluminum
AW - Aluminum Clad Wood

Psi-Opaque Grade (PO)

Frame-spacer grade is based on combining the frame heat transmission and the edge-of glass effect into a single linear heat loss coefficient. This provides a basis for comparison of frames of different widths and different frame-spacer combinations.

PO [Btu/h.ft.F]	Frame-Spacer Grade
<=0.065	A+
<=0.110	A+
<=0.155	B
<=0.200	C
>0.200	D

Downloadable datasheets (.pdf) and therm files (.zip) for each listing

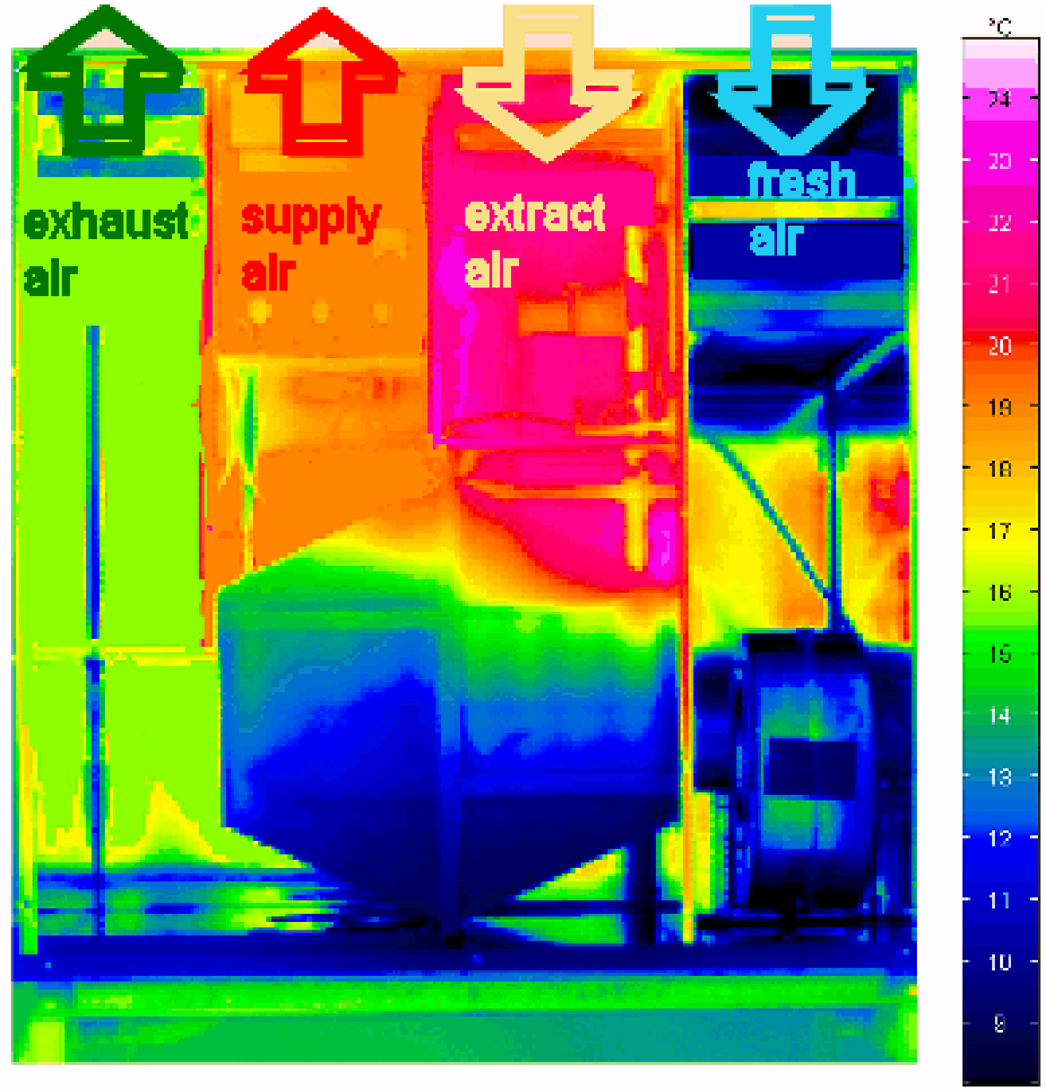
Recommendations by climate zone

Climate zone map

	Model	Glazing	FM	PO	South - Facing 8	7	6	5	4	4C	3C	3	2B	2A	North, East, West - Facing 8	7	6	5	4	4C	3C	3	2B	2A	Datasheet	thm
Alpen	525-SH Casement	108	FG	B																					datasheet	.zip
Alpen	525-S SL Casement	200	FG	B							☑	☑													datasheet	.zip
Alpen	525-S Casement SS-L2	17	FG	B							☑	☑	☑	☑							☑	☑	☑	☑	datasheet	.zip
Alpen	525-S Fixed HP SS-H	108	FG	B																					datasheet	.zip
Alpen	525-S Fixed HP SS-L	[illegible]	FG	[illegible]							☑	☑								☑					datasheet	.zip

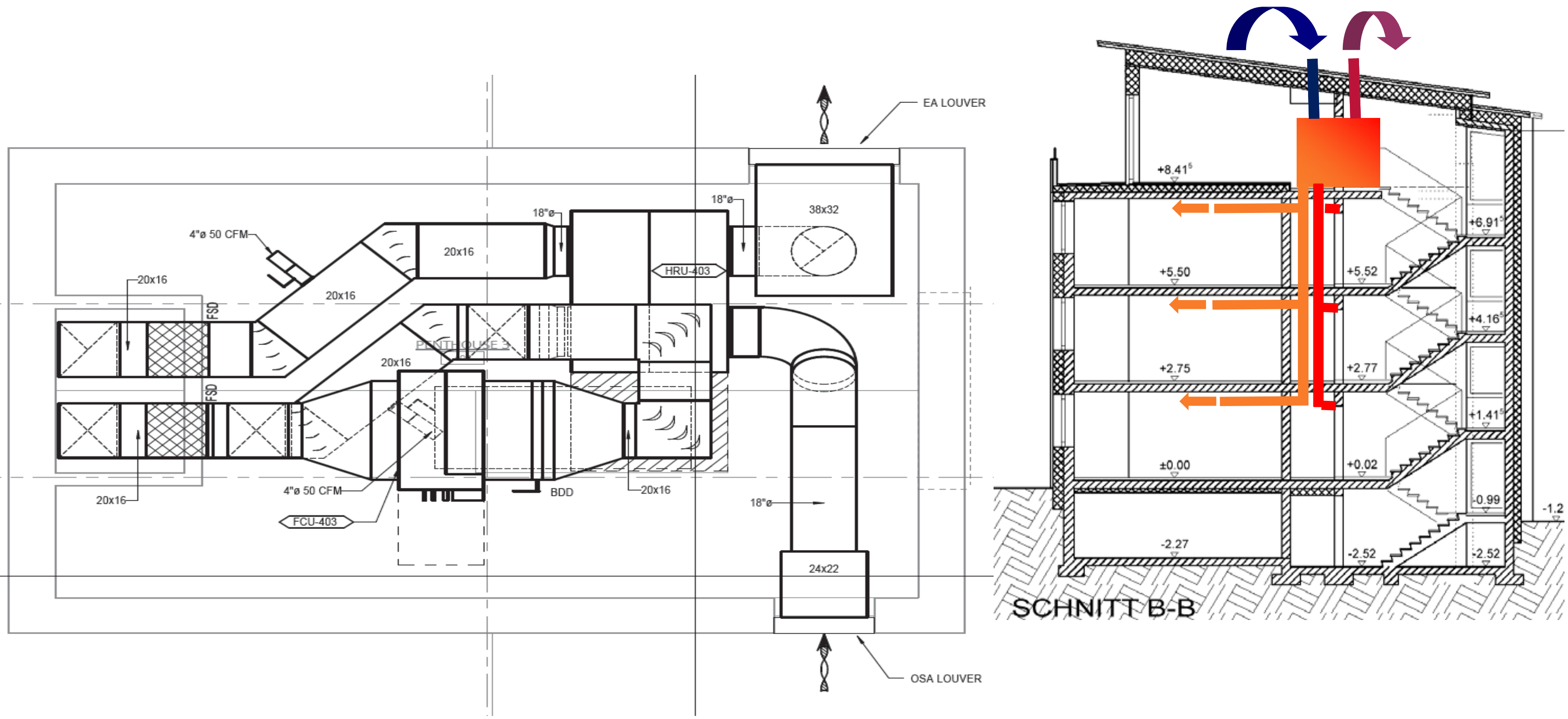
BALANCED VENTILATION

HEAT RECOVERY & SPACE CONDITIONING

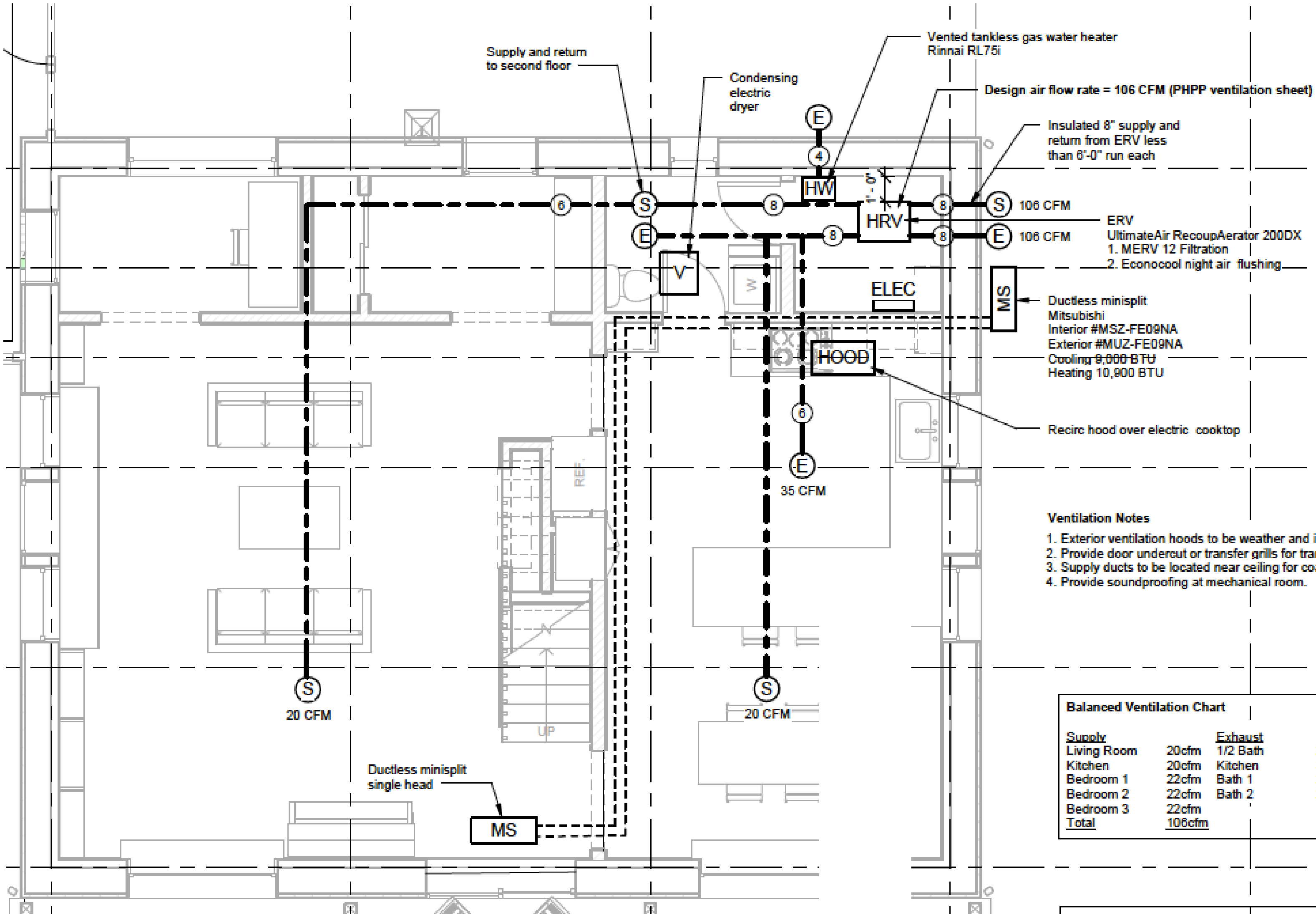


CENTRALIZED VENTILATION
W/INTEGRATED SPACE CONDITIONING

Source: 2014 NAPHC Proceedings, Orchards at Orenco



DECENTRALIZED SOLUTION



Ventilation Notes

1. Exterior ventilation hoods to be weather and insect protected.
2. Provide door undercut or transfer grills for transfer air.
3. Supply ducts to be located near ceiling for coanda effect.
4. Provide soundproofing at mechanical room.

Balanced Ventilation Chart

Supply		Exhaust	
Living Room	20cfm	1/2 Bath	23cfm
Kitchen	20cfm	Kitchen	35cfm
Bedroom 1	22cfm	Bath 1	24cfm
Bedroom 2	22cfm	Bath 2	24cfm
Bedroom 3	22cfm		
Total	106cfm		106cfm

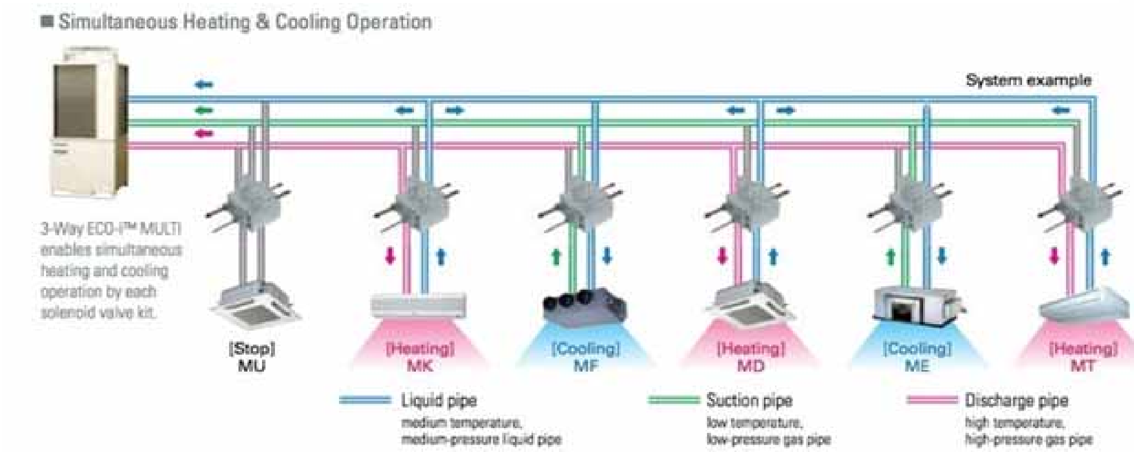
SEMIDECENTRALIZED

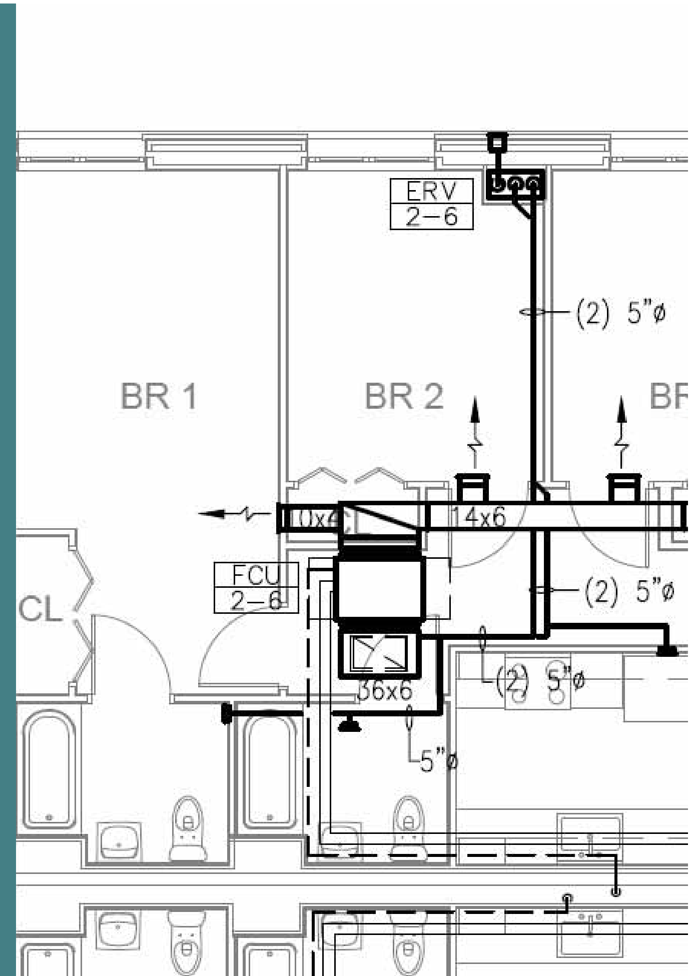
Most common solution - Individual ventilator in each unit

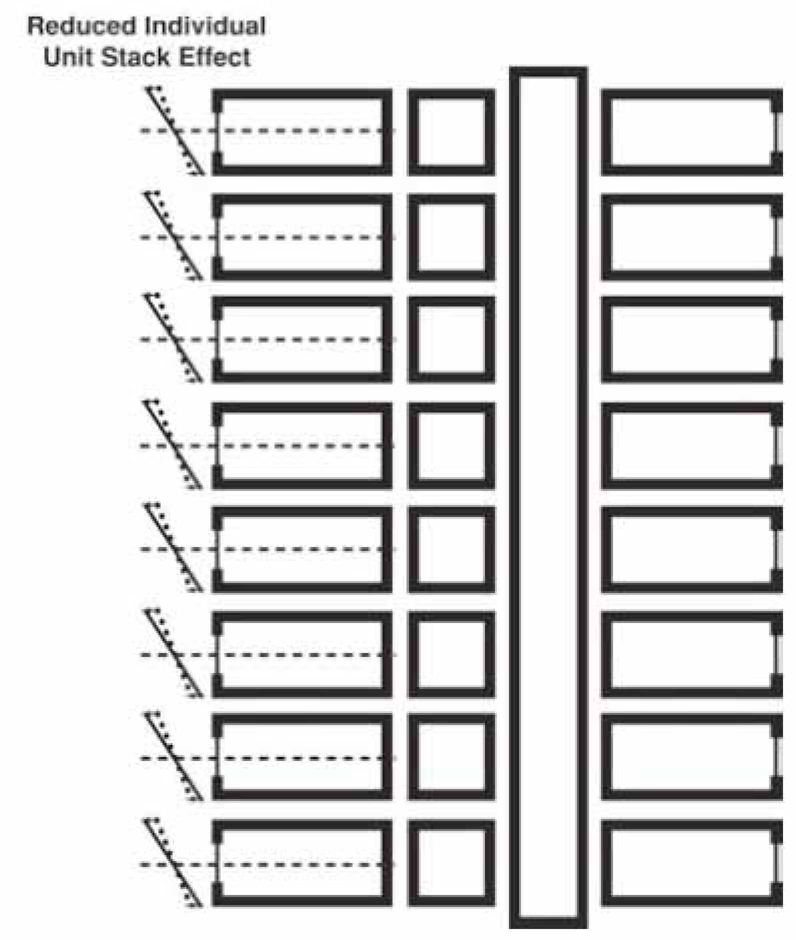
- Better controls, more accurate ventilation air delivery
- Solution for local codes where exhaus can not be drawn from all apartments and go through a common air to air heat exchanger

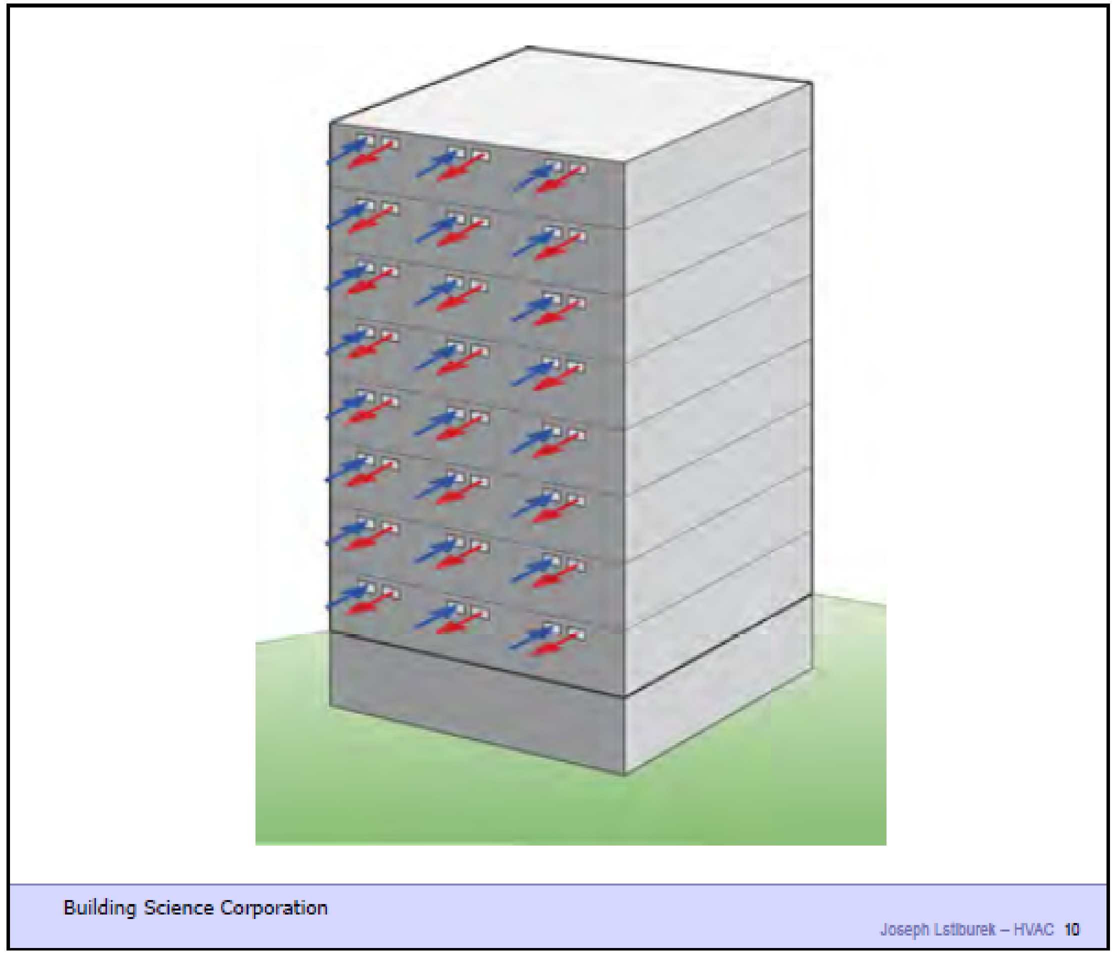
Space conditioning via central VRF system

- Separate supply ducts from ventilatio air due to different air velocities during space conditioning







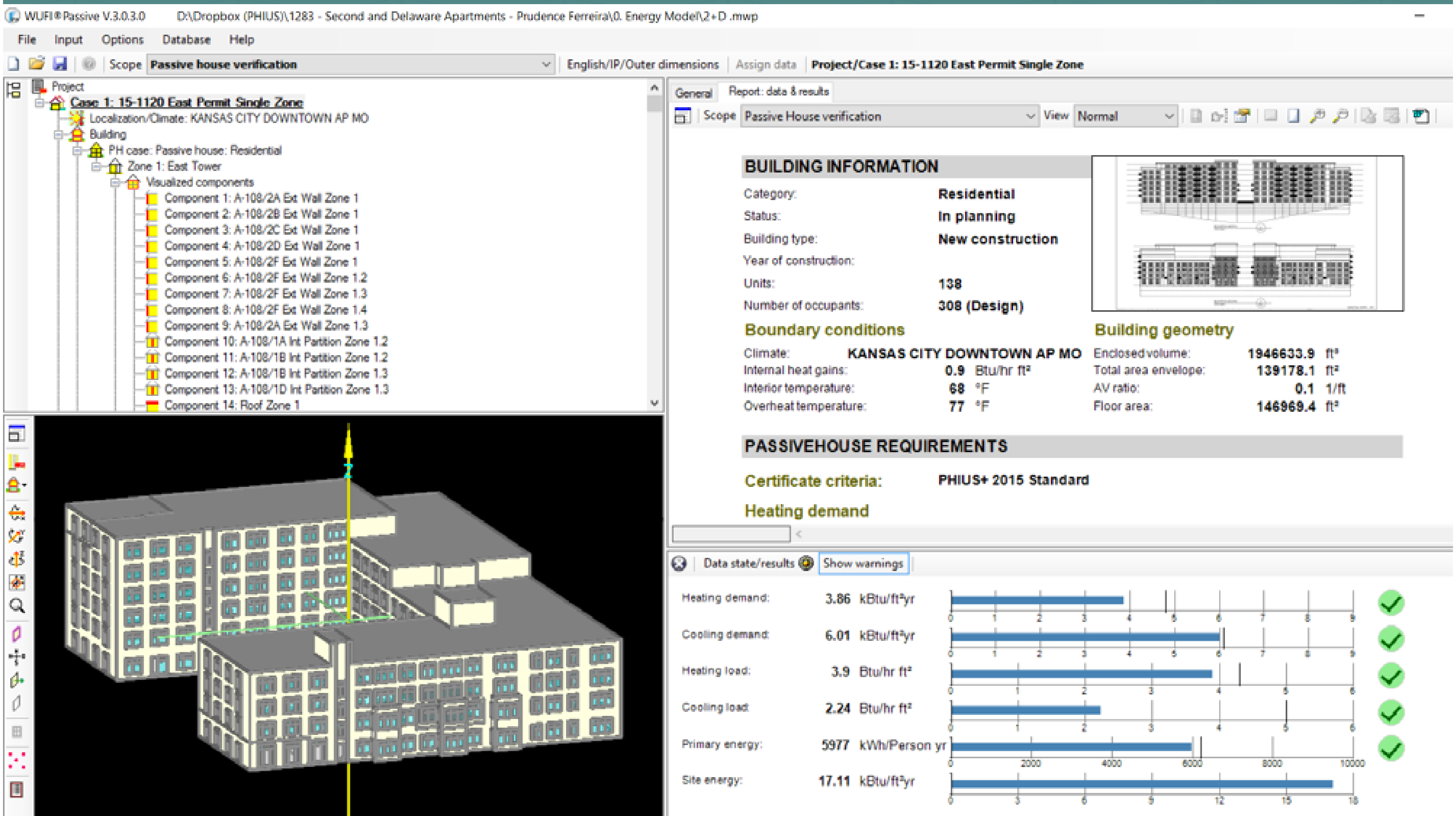


COMPARTMENTALIZATION

OF UNITS TO **CONTROL STACK** EFFECT

IDEALLY ONE **VENTILATOR** PER UNIT FOR INDIVIDUAL CONTROL

WUFI **PASSIVE** VERIFICATION



Second & Delaware – CPHC Prudence Ferreira – PHIUS+ 2015 project

INCENTIVES, LEGISLATION, FINANCIAL TOOLS

LEGISLATION & INCENTIVES

MASSACHUSETTS

780 CMR: STATE BOARD OF BUILDING REGULATIONS & STANDARDS

N1106.1.1 (R406.1.1) Approved Alternative Energy Performance Methods. The following rating threshold criteria are sufficient to demonstrate energy code compliance under section N1106 without calculation of a standard reference design. The mandatory provisions of subsection N1106.2 also apply:

1. ENERGY STAR Homes 3.1 path.

2. Passive House Institute US (PHIUS) Approved Software. PHIUS+ 2015: Passive Building Standard - North America, or another approved software by PHIUS, where Specific Space Heat Demand, as modeled by a Certified Passive House Consultant, is less than or equal to 10 kBTU/ft²/year. Compliance with this section requires that the criteria of C402.4, C403.2, C404, and C405 are met.

MASSACHUSETTS

780 CMR: STATE BOARD OF BUILDING REGULATIONS & STANDARDS

C407.6.1.1 Approved Alternative Energy Performance Methods. The requirements of this section are approved performance methods to demonstrate compliance with Section C407 without calculation of a standard reference design:

1. RESNET Approved Software for Home Energy Rating System (HERS).

2. Passive House Institute US (PHIUS) Approved Software. PHIUS+ 2015: Passive Building Standard - North America, or another approved software by PHIUS, where Specific Space Heat Demand, as modeled by a Certified Passive House Consultant, is less than or equal to 10 kBTU/ft^2/year. Compliance with this section requires that the criteria of C402.4, C403.2, C404, and C405 are met.

HUD INCENTIVES

Energy Efficiency Measures in MF Projects

Multifamily Accelerated Processing (MAP) Guide, 4430.G: FHA explicitly recognizes and underwrites projected utility savings resulting from energy efficiency improvements. To qualify for these credits, projects must demonstrate proposed savings through an energy audit. FHA will underwrite up to 75 percent of proposed savings.

FHA to cut Mortgage Insurance Rates on Multifamily Mortgages: The rate reductions announced today will take effect on April 1, 2016, and will directly impact FHA's Multifamily Housing Programs and properties housing low- and moderate-income families and/or developments installing energy-efficient systems or building within federal energy guidelines.

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

U.S. Department of Energy Zero Energy Ready Home™

ZERO ENERGY READY HOME U.S. DEPARTMENT OF ENERGY PARTNER

LENDER PARTNER AGREEMENT

PHIUS Passive House Institute US

This agreement is administered by the U.S. Department of Energy (DOE) in support of DOE Zero Energy Ready Home™ program. It is being coordinated with the U.S. Environmental Protection Agency (EPA) ENERGY STAR™ Certified Home and Passive House Institute US (PHIUS) high-performance home labeling programs. This is only an agreement between DOE and the Lending Partner, and therefore does not entitle

(Original Signature of Member)

112TH CONGRESS
1ST SESSION

H. R. ______

To facilitate and encourage construction and rehabilitation of buildings using the Passive House Building Energy Standard.

IN THE HOUSE OF REPRESENTATIVES

Mr. INSLEE introduced the following bill; which was referred to the Committee on ______________

A BILL

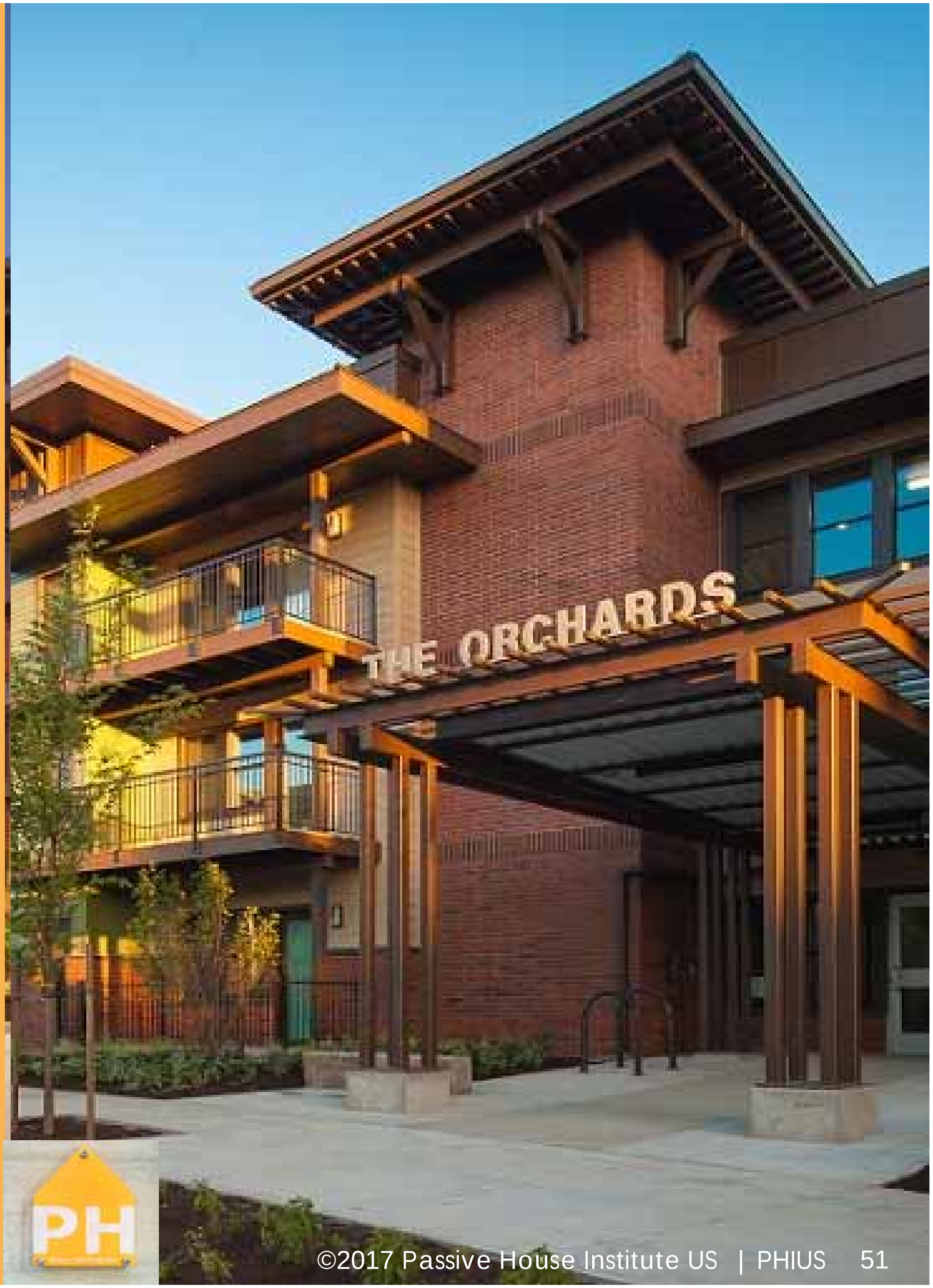
To facilitate and encourage construction and rehabilitation of buildings using the Passive House Building Energy Standard.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Passive House Act of 2011".

EXAMPLE PROJECTS



Orenco Station, Portland, OR, 57 Units

80 UNIT SRO MULTIFAMILY BUILDING RETROFIT

18 UNIT MULTIFAMILY BUILDING
MARKET RATE

Kiln Appartments,Portland, Oregon

PASSIVE BUILDINGS

Stellar Apartments, 16 Units, Eugene, OR

Knickerbocker Project, 24 Units, Brooklyn, NY, Chris Benedict

AFFORDABLE DEVELOPMENTS

UPTOWN LOFTS - AFFORDABLE DEVELOPMENT IN PITTSBURGH

Uptown Lofts, Pittsburgh, PA

FIRST AFFORDABLE FULLY CERTIFIED 24 UNIT BUILDING

Orchards at Orenco Station Phase II, Portland, OR

ORCHARDS AT ORENCO PHASE II

RECENTLY COMPLETED

Weinberg Commons, Washington DC

AFFORDABLE RETROFIT PROJECT IN WASHINGTON DC

CHOM Village Center, Brewer, ME

COMPLETED - DEVELOPMENT WITH 47 UNITS


W 153rd St, New York, NY
PH

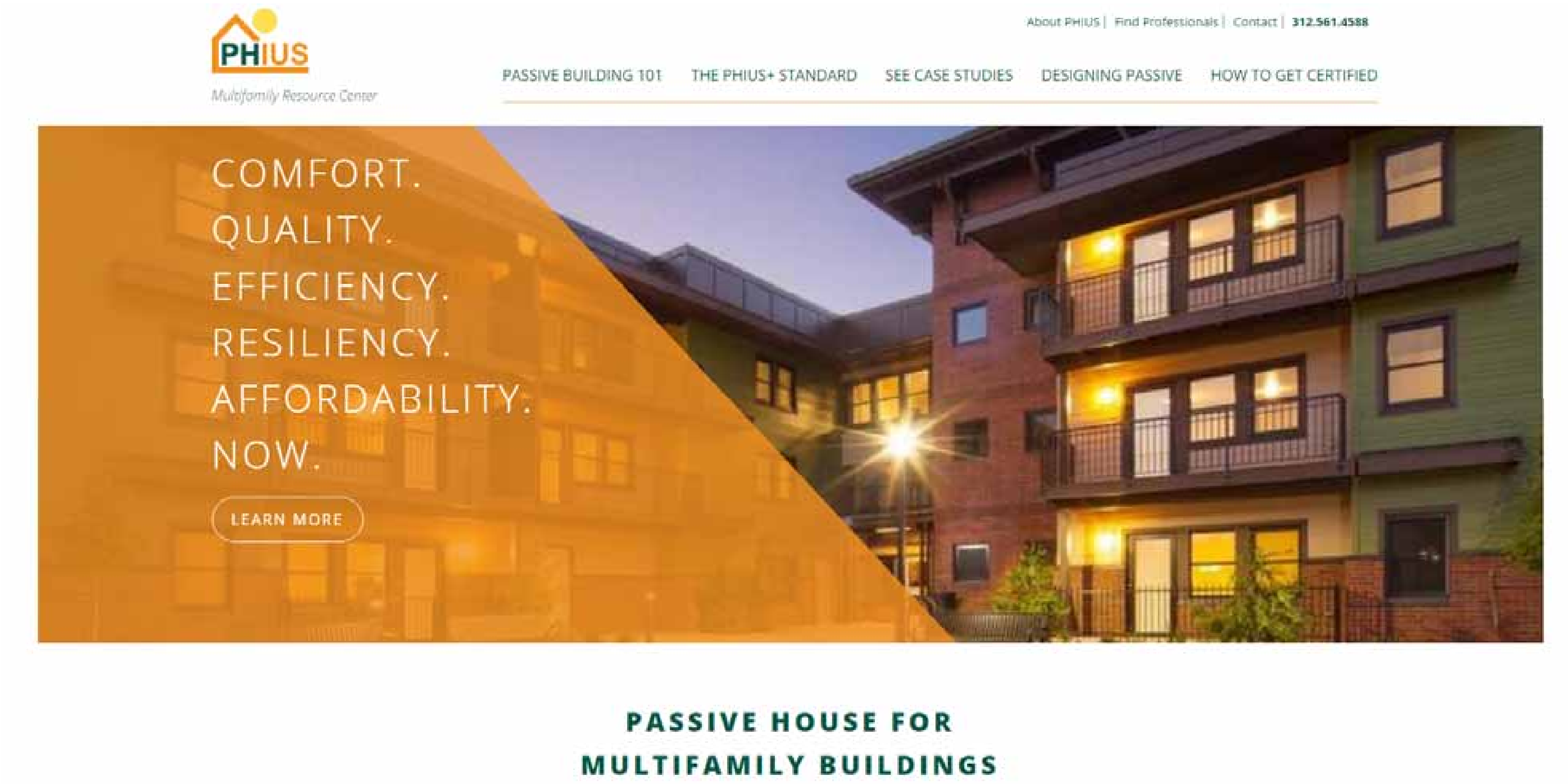
Beach Green North, New York, NY

LARGEST MIDRISE UNDER CONSTRUCTION WITH 101 UNITS

3365 3rd AVENUE, BRONX, NY

HI-RISE PLANNED FOR BRONX, NY

PHIUS MULTIFAMILY
RESOURCE CENTER



Source: http:/multifamily.phius.org/

PHIUS MULTIFAMILY RESOURCE CENTER

DEVELOPERS WEBINAR SERIES

ORCHARDS AT ORENCO (PHASE I) PROJECT, HILLSBORO, OR

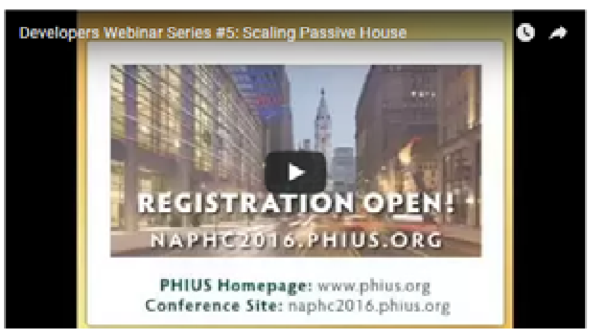
JESSICA WOODRUFF, HOUSING DIRECTOR AT REACH
CRAIG KELLEY, SENIOR PROJECT MANAGER WITH HOUSING DEVELOPMENT CEN

Originally aired April 28, 2016

SCALING PASSIVE HOUSE, 2ND & DELAWARE, KANSAS CITY, MO

JONATHAN ARNOLD, PRINCIPAL, ARNOLD DEVELOPMENT

Originally aired May 17, 2016



MULTIFAMILY PASSIVE BUILDING PROJECTS

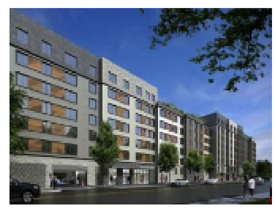
The **PHIUS+2015 Passive Building Standard** ignited the rapid growth of multifamily passive buildings from coast to coast. Learn more about proven best practices in the following case studies.

ORCHARDS AT ORENCO, OR

The Orchards at Orenco in suburban Portland, Oregon, is currently the largest multifamily passive building development in North America.

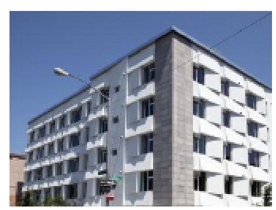
UPTOWN LOFTS ON FIFTH, PA

ACTION-Housing developed Uptown Lofts on Fifth in Pittsburgh to provide affordable housing with affordable utilities made possible by the high-performance passive building envelope.



BEACH GREEN NORTH, NY

Beach Green North, designed to meet passive building standards, also includes resilient features to weather heavy storm conditions in Far Rockaway, Queens, New York.



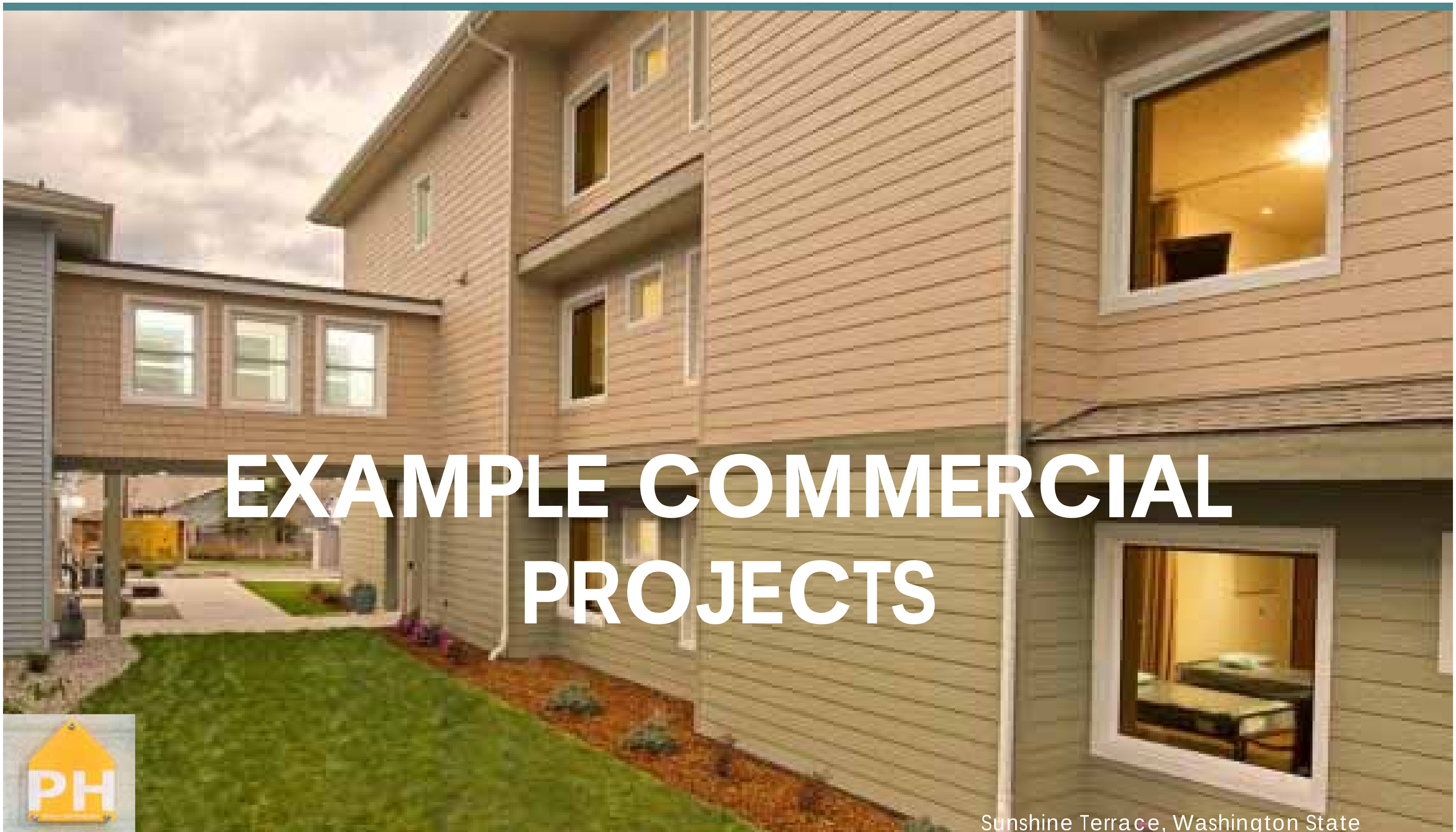
KNICKERBOCKER COMMONS, NY

Knickerbocker Commons is a six-story affordable multifamily passive building development in the Bushwick neighborhood of Brooklyn, New York.

PERCH HARLEM, NY

The Perch Harlem development is New York City's first market rate

EXAMPLE COMMERCIAL PROJECTS



Sunshine Terrace, Washington State

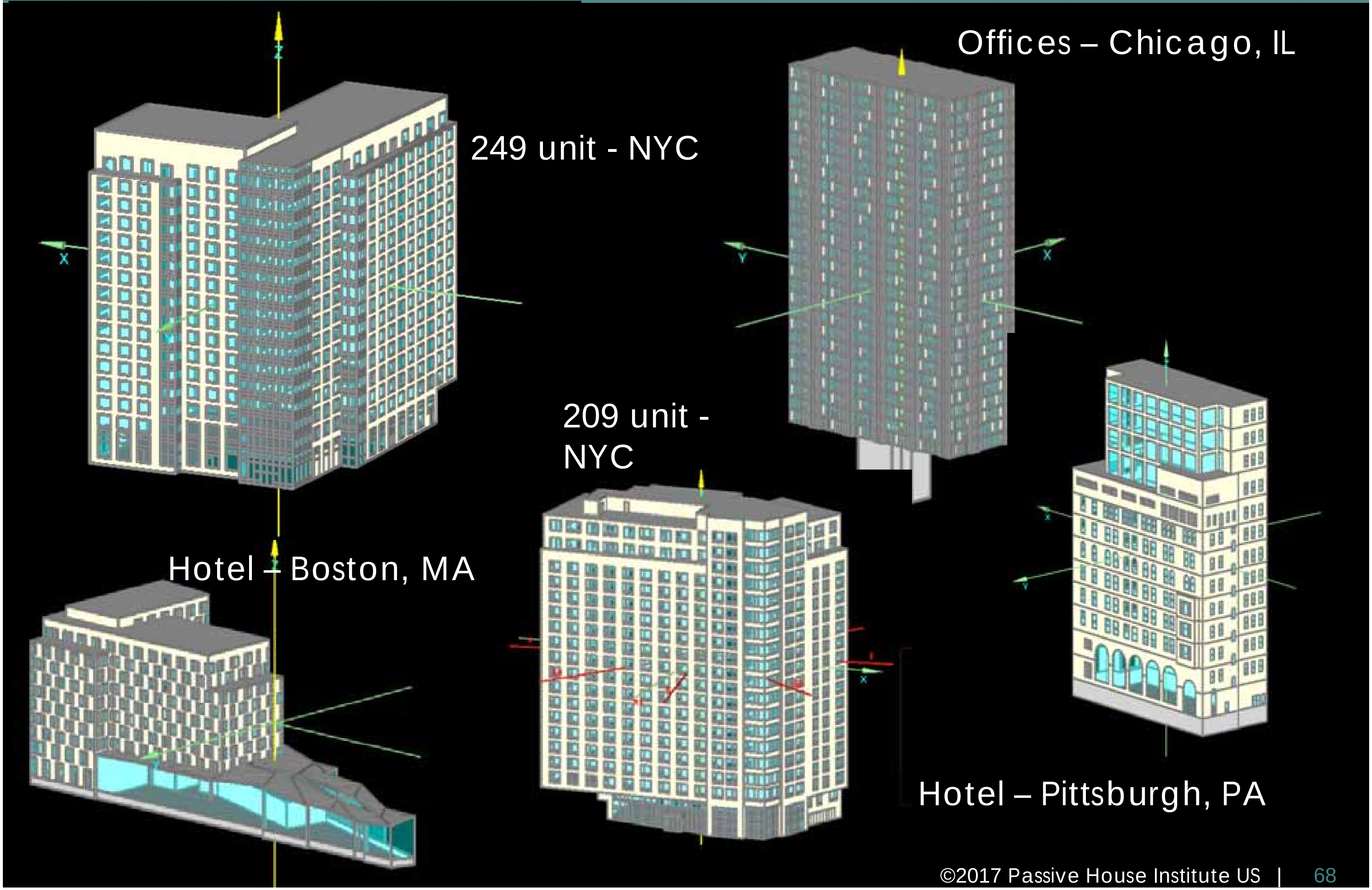
FIRST LICENSED HEALTH FACILITY, 34 UNITS

FIRST CHURCH

KINDERHOOK

NEW RMI HEADQUARTERS IN BASALT

FEASIBILITY STUDIES



PASSIVE BUILDING

IS PART OF THE SOLUTION

Katrin Klingenberg, Executive Director
www.PHIUS.org/www.PHAUS.org

PHIUS Passive House Institute US

PASSIVE HOUSE ALLIANCE UNITED STATES