EEBA 2015, DENVER CO:
VALUE-DRIVEN PASSIVE HOUSE DESIGN STRATEGIES FOR MULTI-FAMILY BUILDINGS

US building impacts

72% electricity consumption

39% energy use

38% CO_2 emissions

40% raw materials

30% waste output

14% potable water use

Greater PHiladelphia Passive House Association

MISSION:

The Greater Philadelphia Passive House Association

Is dedicated to making Passive House design and construction

a mainstream practice.

US building impacts

72% electricity consumption

39% energy use

38% CO_2 emissions

40% raw materials

30% waste output

14% potable water use

LEARNING OBJECTIVES

1. Learn how passive technologies and the 'whole-building' approach can be implemented to achieve high performance buildings.
1. Discover the financial advantages of conservation-driven design over traditional efficiency approaches, particularly for fixed income constituents.
2. Understand the advantages of Passive House Certification and how it can be applied or used in combination with other green building certifications.
3. Appreciate the health, acoustic and comfort advantages of Passive House designed projects.

BLUPATH

INSPIRING DESIGN FOR PLACES TO THRIVE

LAURA BLAU AIA, LEED BD&C® AP
CPHC (Certified Passive House Consultant)
CPHB (Certified Passive House Builder)
CPHD (Certified Passive House Designer-pending)
Principal-in-Charge

Woman-owned, award winning architecture and design firm focusing on high-performance building design.

blupath.us

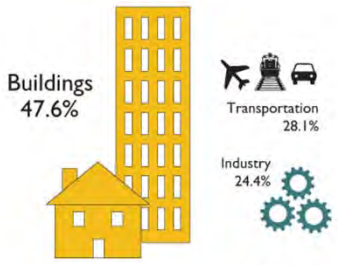
Certified WBENC Women's Business Enterprise

AGENDA

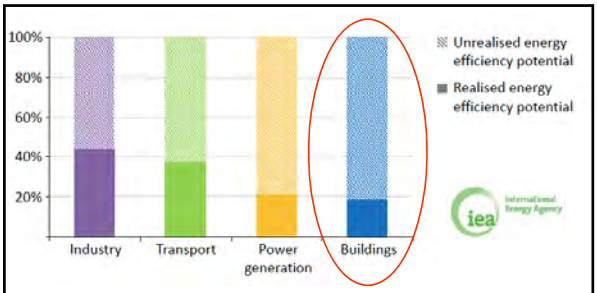
1. Set the stage: Building's global role.
2. Bust some Passive House myths.
3. Explain the Passive House Standard.
4. Understand how to implement and optimize energy savings in Multi-family projects.
5. Remind us of the big picture.
6. Discussion and Q & A.

EEBA 2015, DENVER CO:
VALUE-DRIVEN PASSIVE HOUSE DESIGN STRATEGIES FOR MULTI-FAMILY BUILDINGS

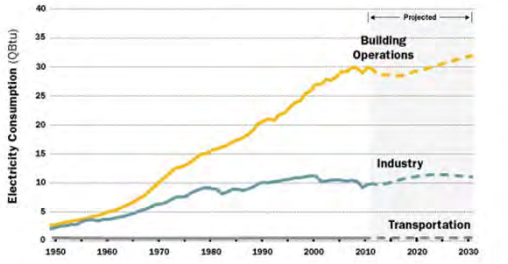
Energy Consumption



U.S. Energy Consumption by Sector



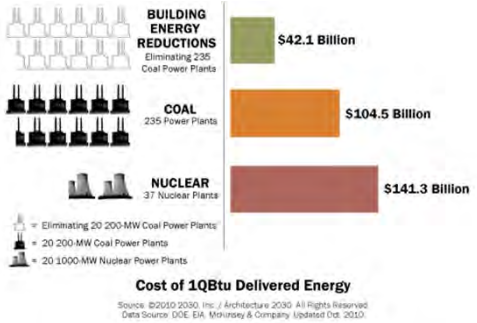
THE BUILDING SECTOR OFFERS THE
GREATEST OPPORTUNITIES
TO REALIZE ENERGY SAVINGS



U.S. Electricity Consumption by Sector (Historic / Projected)

MEETING THE CHALLENGE

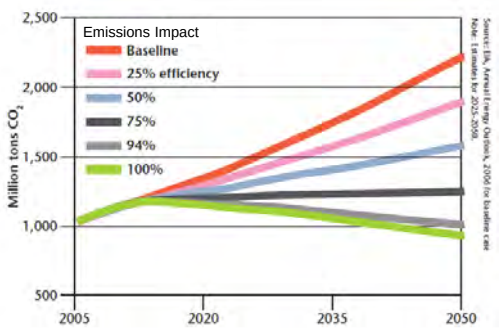
DESIGN STRATEGIES + TECHNOLOGY, SYSTEMS & ON-SITE RENEWABLES + OFF-SITE RENEWABLES



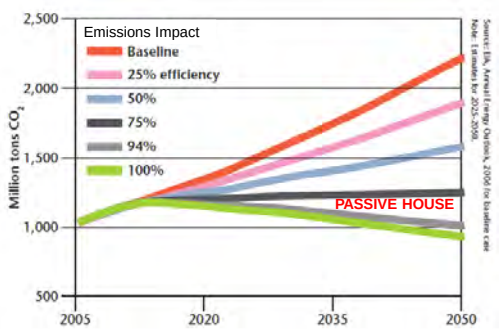
Cost of 1QBtu Delivered Energy

EFFICIENT BUILDINGS ARE **LESS EXPENSIVE**
THAN POWER PLANTS

THE SCALE OF THE BUILDING ENERGY CHALLENGE



THE SCALE OF THE BUILDING ENERGY CHALLENGE



Civic House Feasibility Study
University of Pennsylvania

What is Passive House?
(PassivHaus)

NORTH AMERICA 1970'S

Lo-Cal House

+

PHI - Germany 1990

WUFI PASSIVE
PHIUS 2012

Passive Solar
Used
15,600 kWH/yr

Passive House
Used
116 kWH/yr
99% less for heating
84% less for cooling

EEBA 2015, DENVER CO:
VALUE-DRIVEN PASSIVE HOUSE DESIGN STRATEGIES FOR MULTI-FAMILY BUILDINGS

Transformer Townhome

MULTI-FAMILY & SENIOR HOUSING
Philadelphia, PA
BluPath, Architect

TERRAHAUS STUDENT RESIDENCE
Unity College, Unity ME
GO Logic, Architect

MULTI-FAMILY MIXED USE
Philadelphia, PA
Onion Flats, Architect

MCKEESPORT YMCA, ACTION-HOUSING
Pittsburgh, PA
Thoughtful Balance, Architect

MULTI-FAMILY SENIOR RESIDENCES
Brooklyn, NY
Chris Benedict, Architect

FUTURE HOUSE MULTIFAMILY PROJECT
Changzhou, China
Ludwig Rongen, Architect

Coffee Analogy #1

Science based

Conservation focused

Better built

Cost effective

=

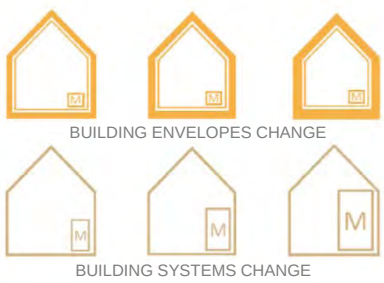
SMART DESIGN

Efficient, comfortable, healthy

ZEC - Zero Energy Capable

Energy Star

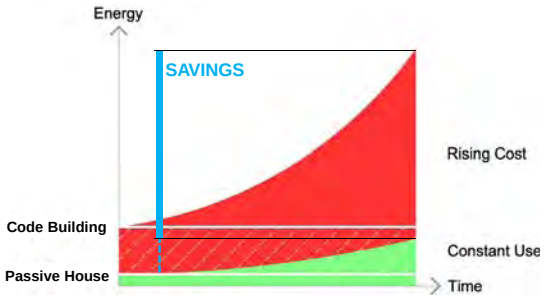
Passive House



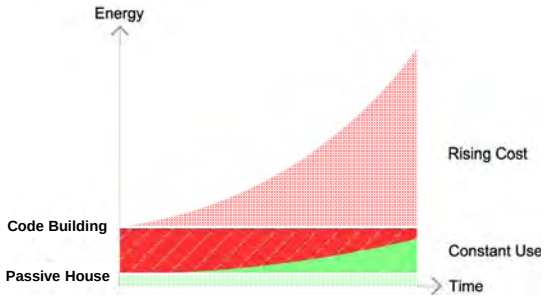
Paradigm Shift

Coffee Analogy #2

Standard Passive House



Energy Savings Over Time



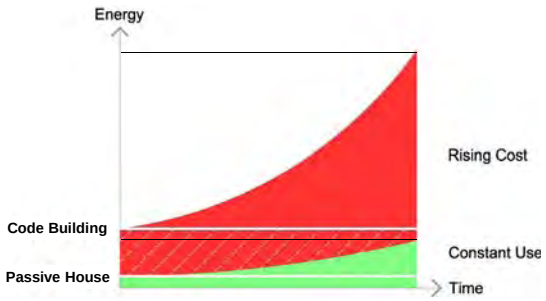
Energy Savings Over Time

BENEFITS BEYOND ENERGY SAVINGS

LABOR IS LOCAL

PEOPLE POWER IS A RENEWABLE RESOURCE

Contributes to the local economy



Energy Savings Over Time

BENEFITS BEYOND ENERGY SAVINGS

LONG TERM VALUE

ENVELOPE IS PERMANENT TO THE BUILDING

Less or smaller mechanical equipment

Lower O&M costs

BENEFITS BEYOND ENERGY SAVINGS

LOWER RISK – MORE DURABLE

Studies show
most envelope failures
are from air leakage and
thermal bridging

Passivhaus Institut

PHIUS
Passive House Institute US

BENEFITS BEYOND ENERGY SAVINGS

HIGHER PRODUCTIVITY

More comfortable,
healthier indoor air quality
higher user satisfaction

BENEFITS BEYOND ENERGY SAVINGS

'Gas Mileage Standard'
for a building

Passive House certification- CLASSIC
Meets rigorous performance standards

Specific heat and cooling demand
<4.75 kBtu/sq ft/ year*
Air tightness
<0.6 ACH @ 50 Pa**
Specific primary energy demand
<38.1 kBtu/sq ft/ year***

NEW!: PHIUS+* ** *** PLUS*** PREMIUM***

BENEFITS BEYOND ENERGY SAVINGS

MORE FUTURE-PROOF – SURVIVABLE
Mitigates issues surrounding
extreme weather
global energy
&
material
availability, cost and scarcity

DESIGNED TO EARN THE ENERGY STAR

x 5

PASSIVE HOUSE CONCEPTS

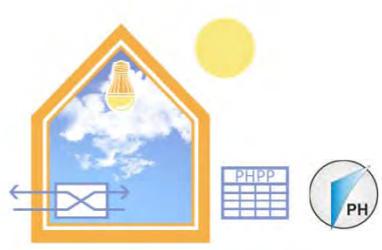
Continuous Ventilation

Super Insulated Air Tight Shell

Efficient Appliances

Optimized Solar Energy

Accurate and Proven Analysis



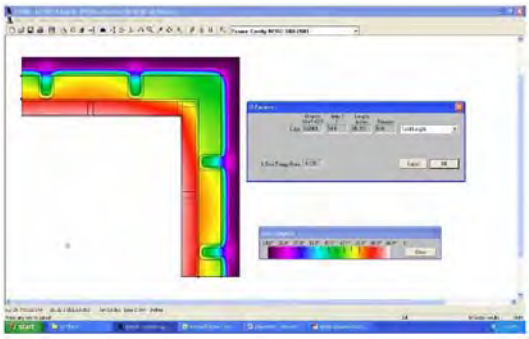
Accurate and Proven Analysis

Typical building Passive House

EFFICIENT

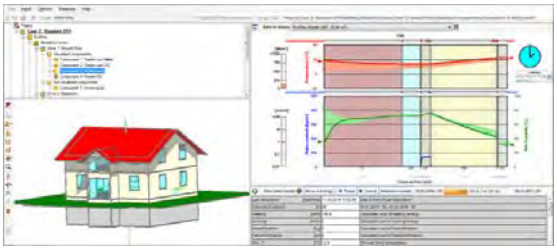
Passive House + Solar Array* =
Net Zero Energy

*PLUS, PREMIUM



THERMAL MODEL
Assembly

25 Years + ~~55,000~~ Units 2012
(ask us about Brussels 2015)

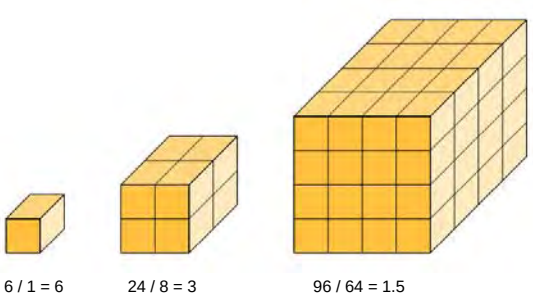


HYGROTHERMIC MODEL
Assembly

WHY IS PASSIVE HOUSE GOOD FOR BIGGER BUILDINGS?

THE PASSIVE HOUSE THERMAL ENVELOPE

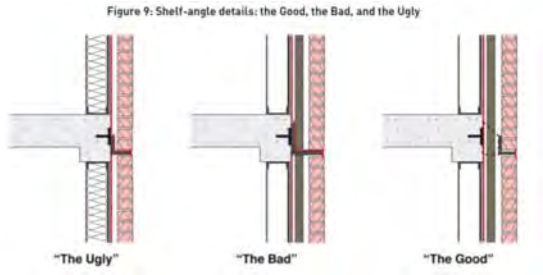
THERMAL BRIDGE FREE CONSTRUCTION
Foam Free is Better



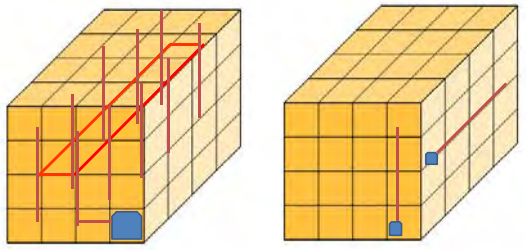
SURFACE TO VOLUME RATIO
LOWER IS BETTER

Hydrophobic	drains & dries
Lightweight	long attachments/ brackets
Non Combustible	fire resistant
Flexible	cuts to size cuts around objects layers easily

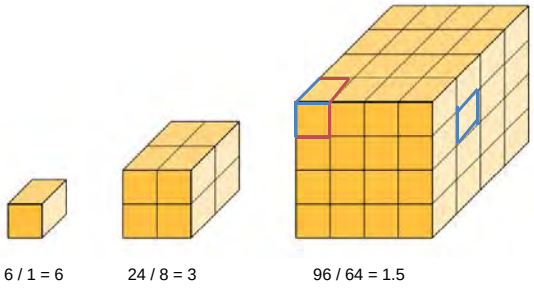
THERMAL BRIDGE FREE CONSTRUCTION
Foam Free is Better



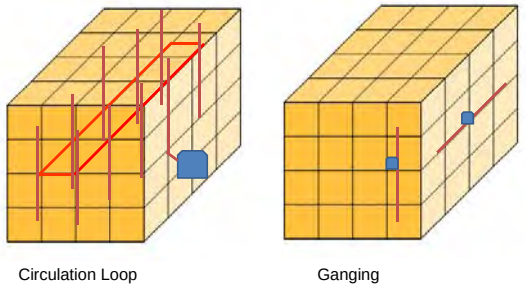
THERMAL BRIDGE FREE CONSTRUCTION
Mind your attachments



DOMESTIC HOT WATER
individual vs group vs district

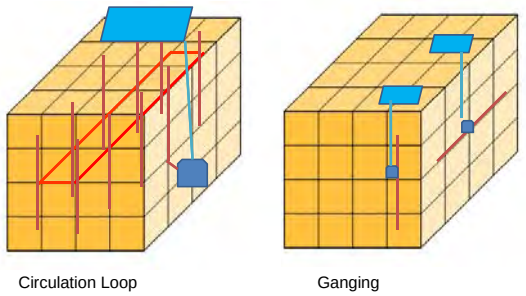


AIR SEALING STRATEGIES
COMPARTMENTIZATION
SURFACE AREA PER UNIT



DOMESTIC HOT WATER
Central Location

DOMESTIC HOT WATER
PASSIVE HOUSE



DOMESTIC HOT WATER
Solar Generation?

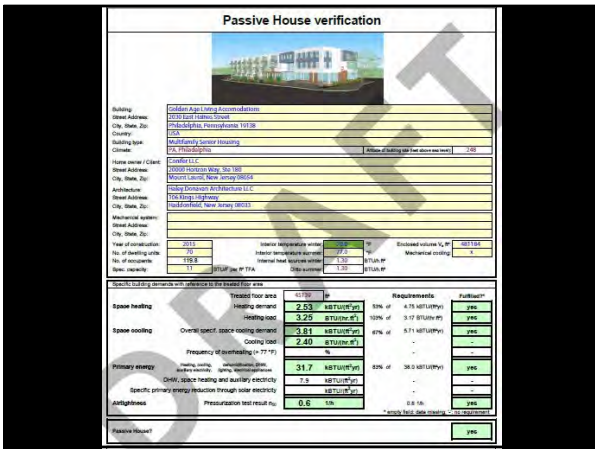
HEAT & A/C
DUCTS
PASSIVE HOUSE
vs STANDARD
CONSTUCTION

Plans are set…. What options do you have?

GALA Senior Residence
Philadelphia PA
Haley Donovan Architects
Conifer Developers

Case Study:
HVAC Ducting
24-Unit Senior Affordable Housing

Fayette County Community Action Corporation
Fairchance, PA
Sleighter Engineering and Architecture, Architect



One Bedroom

Two Bedroom

Heat & A/C Ducts
Standard Construction

Heat & A/C Ducts
Standard Construction

Standard Construction
3,670 Linear Ft of Heat & A/C Ducting

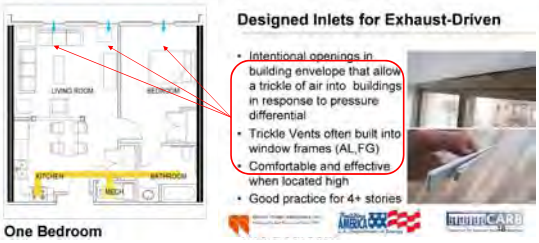
Passive House
620 Linear Ft of Heat & A/C Ducting

Heat & A/C Ducts
Passive House
Fewer and smaller ducts

VENTILATION DUCTS PASSIVE HOUSE vs STANDARD CONSTUCTION

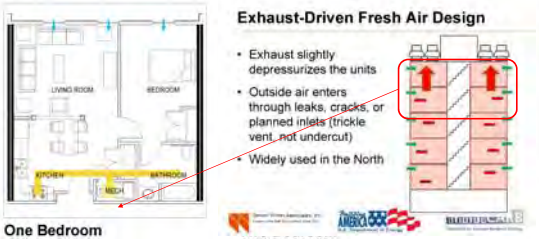
Heat & A/C Ducts
Passive House
Fewer and smaller ducts

Ventilation Ducts
Standard Construction

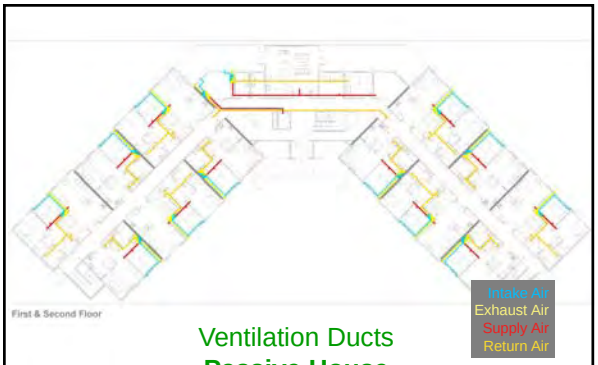


Ventilation Ducts
Standard Construction

Ventilation Ducts
Passive House
≥75% Energy is recovered from ventilation



Ventilation Ducts
Standard Construction



Ventilation Ducts
Passive House
≥75% Energy is recovered from ventilation

Ventilation Ducts
Standard Construction

Standard Construction
1,158 Linear Ft of Ventilation Ducting

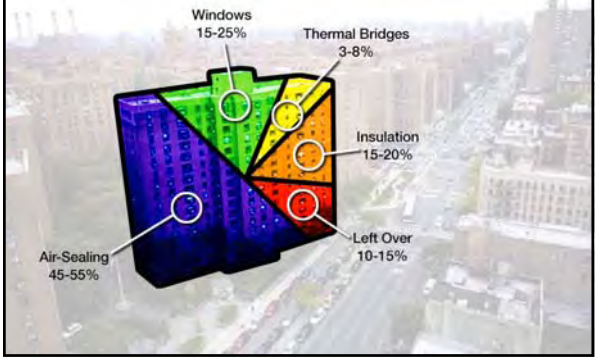
Passive House
1,772 Linear Ft of Ventilation Ducting

Combined Ventilation and Heat & AC Ducting

Standard Construction
4,828 Linear Ft of HVAC Ducting

Passive House
2,392 Linear Ft of HVAC Ducting

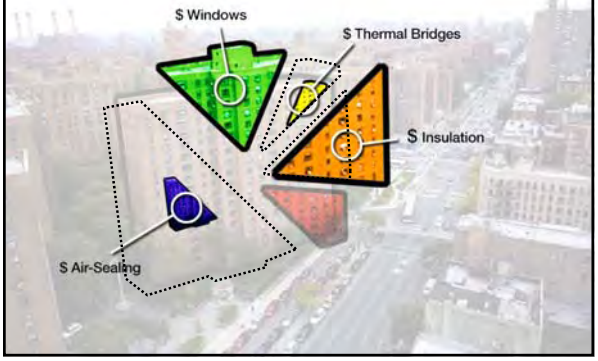
Thermal Components:
Performance breakdown towards PH goal



STANDARD	QTY	PASSIVE HOUSE	QTY
VRF Heat Pump Units	*3*	Air to Air Heat Pump Units	*28*
Vertical Air Handlers	*28*	Energy Recovery Ventilators	*26*
Local Exhaust Fans	*56*		
Roof Exhaust Fans	14		
Trickle Vents	*128*		

HVAC Equipment
Standard Construction vs
Passive House

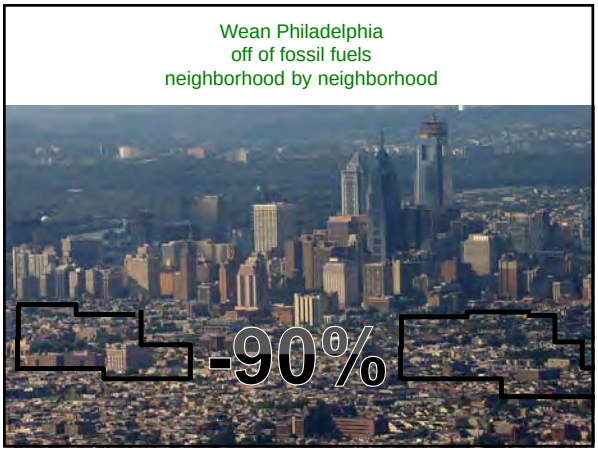
Thermal Components:
How much do they cost?



A skyline of work. One at a time.

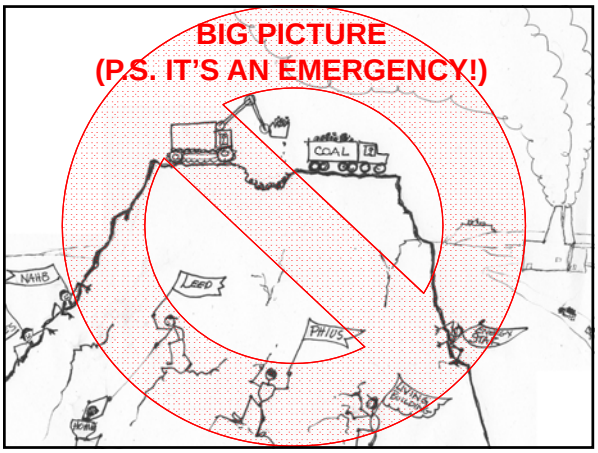
ANOTHER PERSPECTIVE ON ENERGY USE

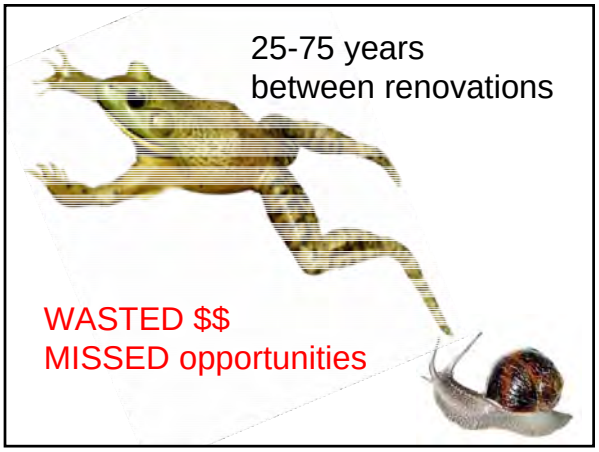
EEBA 2015, DENVER CO:
VALUE-DRIVEN PASSIVE HOUSE DESIGN STRATEGIES FOR MULTI-FAMILY BUILDINGS



60 % OF THE WORLD'S BUILDINGS
WILL BE REBUILT
IN THE NEXT TWO DECADES.
"That is a **huge opportunity** if we **do it right."**
– Ed Mazria, Architecture 2030

BIG PICTURE
(P.S. IT'S AN EMERGENCY!)





PATHS UP THE MOUNTAIN

RESOURCES

PHIUS Passive House Institute US
passivehouse.us

PHAUS Passive House Alliance US
phaus.org

PHI Passive House Institute (Germany)
passiv.de/en/

iPHA International Passive House Association
passivehouse-international.org

NAPHN North American Passive House Network
northamericanpassivehousenetwork.com

RESOURCES

ENERGY STAR Building rating system - energy
energystar.gov

LEED Building rating system
new.usgbc.org/leed

GREEN GLOBES Building rating system
greenglobes.com

2000 WATT SOCIETY Global energy effects
novatlantis.ch/en/2000-watt-society

GREEN LEASES Landlord tenant relationships
greenleaselibrary.com

ECONOMICS OF PASSIVE HOUSE

RETURN ON INVESTMENT
LIFE CYCLE ANALYSIS
PRESENT VALUE ANALYSIS

Price of Saved Energy = $\frac{(a_{loan} * (I_{add} - R)+Z)}{E_{saved}}$

Net Present Value (NPV) = $K_0 * \frac{1-(1+p)^{-n}}{p}$

RESOURCES

SG BUILD Construction methods consultants
sgbuild.com

FOURSEVENFIVE High performance building supply, foursevenfive.com

STRUCTURESdb Design-build
structuresdb.com

THE CLIMATE TRUST Climate solutions for government, utilities and large businesses
climatetrust.org

3 Prerequisites
47 Credits
3 'Synergy' Prerequisites
31 'Synergy' Credits
40-49 Certified
50-59 Silver
60-79 Gold
80-110 Platinum
110 Possible Points
47-78 PASSIVE HOUSE POINTS

LEED v4 MULTI-FAMILY + Passive House

RESOURCES

Greater PHiladelphia Passive House Association

A WINNING COMBINATION

Passive House + LEED
+ LBC
+ DOE
+ …

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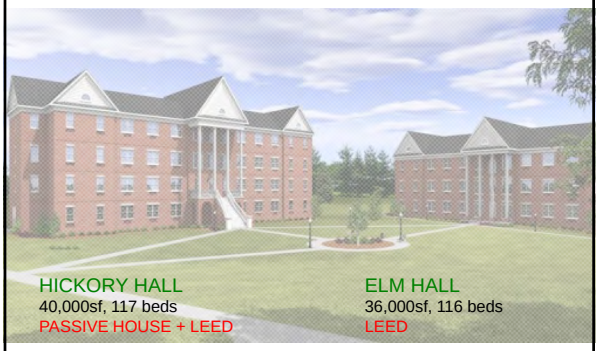
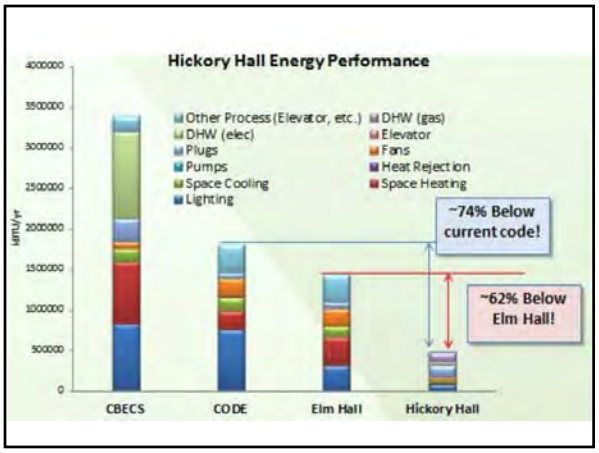




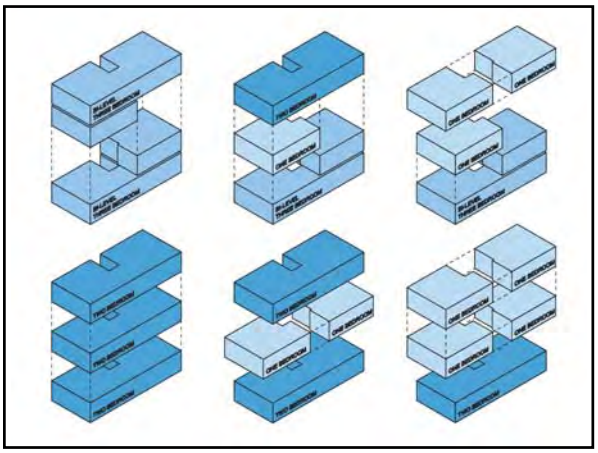
STABLE NEIGHBORHOODS

DIVERSE- RACE, CLASS, GENDER, TYPE, AGE
CULTURE IDENTIFY & HISTORY
DURABLE BUILDINGS
HEALTHY SPACES
LOCAL LABOR
LONG TERM VALUE
STABLE UTILITY COSTS
FUTURE PROOF

SYNERGYSITC MODELS

Studies show a need for housing that can-

- Adapt to the changing demographics
- Accessible and support aging-in-place
- Adapt as families grow and change
- Accommodate singles
- Allow for home offices



Transformer Townhome

Transformer Townhome