MISSION:

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.

US building impacts
72% electricity consumption
39% energy use
38% CO₂ 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.
2. Discover the financial advantages of conservation-driven design over traditional efficiency approaches, particularly for fixed income constituents.
3. Understand the advantages of Passive House Certification and how it can be applied or used in combination with other green building certifications.

AGENDA
1. Set the stage: Building’s global role.
2. Bust some Passive House myths.
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.
Energy Consumption

Efficient buildings are less expensive than power plants.

The building sector offers the greatest opportunities to realize energy savings.

Meeting the challenge

Design strategies + technology, systems & on-site renewables + off-site renewables.

The scale of the building energy challenge
What is Passive House? (PassivHaus)

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

FUTURE HOUSE MULTIFAMILY PROJECT
Changzhou, China
Ludwig Rongen, Architect

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

MULTI-FAMILY SENIOR RESIDENCES
Blauvelt, NY
Ludwig Rongen, Architect
Science based  
Conservation focused  
Better built  
Cost effective  
=  
SMART DESIGN  
Efficient, comfortable, healthy  
ZEC - Zero Energy Capable
Standard Passive House

Energy Savings Over Time

BENEFITS BEYOND ENERGY SAVINGS

LABOR IS LOCAL

PEOPLE POWER IS A RENEWABLE RESOURCE

Contributes to the local economy

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.

BENEFITS BEYOND ENERGY SAVINGS

HIGHER PRODUCTIVITY

More comfortable, healthier indoor air quality higher user satisfaction

'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

x 5
PASSIVE HOUSE CONCEPTS

Super Insulated Air Tight Shell

Continuous Ventilation

Efficient Appliances

Optimized Solar Energy

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

Accurate and Proven Analysis

Typical building

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

BLUPATH © 10/4/2015
WHY IS PASSIVE HOUSE GOOD FOR BIGGER BUILDINGS?

**SURFACE TO VOLUME RATIO**

Lower is Better

\[
\frac{6}{1} = 6 \\
\frac{24}{8} = 3 \\
\frac{96}{64} = 1.5
\]

THE PASSIVE HOUSE THERMAL ENVELOPE

**THERMAL BRIDGE FREE CONSTRUCTION**

Foam Free 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

AIR SEALING STRATEGIES
COMPARTMENTIZATION
SURFACE AREA PER UNIT

DOMESTIC HOT WATER
individual vs group vs district

DOMESTIC HOT WATER
Central Location

DOMESTIC HOT WATER
PASSIVE HOUSE

DOMESTIC HOT WATER
Solar Generation?
HEAT & A/C DUCTS
PASSIVE HOUSE vs STANDARD CONSTRUCTION

Plan are set... What options do you have?

Case Study:
HVAC Ducting
24-Unit Senior Affordable Housing

GALA Senior Residence
Philadelphia PA
Haley Donovan Architects
Conifer Developers

Heat & A/C Ducts
Standard Construction
Heat & A/C Ducts
Standard Construction

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

VENTILATION DUCTS
PASSIVE HOUSE vs STANDARD CONSTRUCTION

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

Ventilation Ducts
Standard Construction
Ventilation Ducts

**Standard Construction**

- Intentional openings in building envelopes that allow a trickle of air into building in response to pressure differential
- trickle vents often built into window frames (ALU/OD)
- Controllable and effective
- When located high - good practice for 4-6 stories

**Passive House**

≥75% Energy is recovered from ventilation

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**Ventilation Ducts**

**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

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:
Performance breakdown towards PH goal

ANOTHER PERSPECTIVE ON ENERGY USE

A skyline of work. One at a time.
62Msf or 65,000 NYC apartments renovated to PASSIVE HOUSE = A single 1.2MW $2B Coal power plant

Wean Philadelphia off of fossil fuels neighborhood by neighborhood
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

25-75 years between renovations

Wasted $$ missed opportunities

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 = \( \frac{(a_{\text{loan}} \cdot (l_{\text{add}} - R) + Z)}{E_{\text{saved}}} \)

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

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

RESOURCES

RESOURCES

RESOURCES

RESOURCES

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

A WINNING COMBINATION

Passive House + LEED
+ LBC
+ DOE
+ …
HICKORY HALL
Emory and Henry College
Emory, Virginia
Adam Cohen, CPHC

HICKORY HALL
40,000sf, $4.73M
$118.25/sf
Passive House + LEED

ELM HALL
36,000sf, $4.59M
$126/sf
LEED

Hickory Hall
2012
71 Points Attempted
7 denied
LEED GOLD PENDING
PASSIVE HOUSE
(LEA 26 Points)

ELM Hall
2010
51 Points Awarded
LEED SILVER
(EA 12 Points)

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
SYNERGISTIC 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