



PASSIVE HOUSE in PENNSYLVANIA



PHFA

PRE-APPLICATION MEETING, OCTOBER 1, 2014

*Tim McDonald, Temple University, Onion Flats, Philadelphia
Laura Nettleton, Thoughtful Balance, Pittsburgh*

BUILDING CODES in PENNSYLVANIA



IECC 2009: current PA code

IECC 2012: current Federal code

IECC 2015: closing in on Net-Zero



CALIFORNIA'S COMMITMENT

Zero Net Energy for Residential Buildings by 2020
Zero Net Energy for Commercial Buildings by 2030

DELAWARE

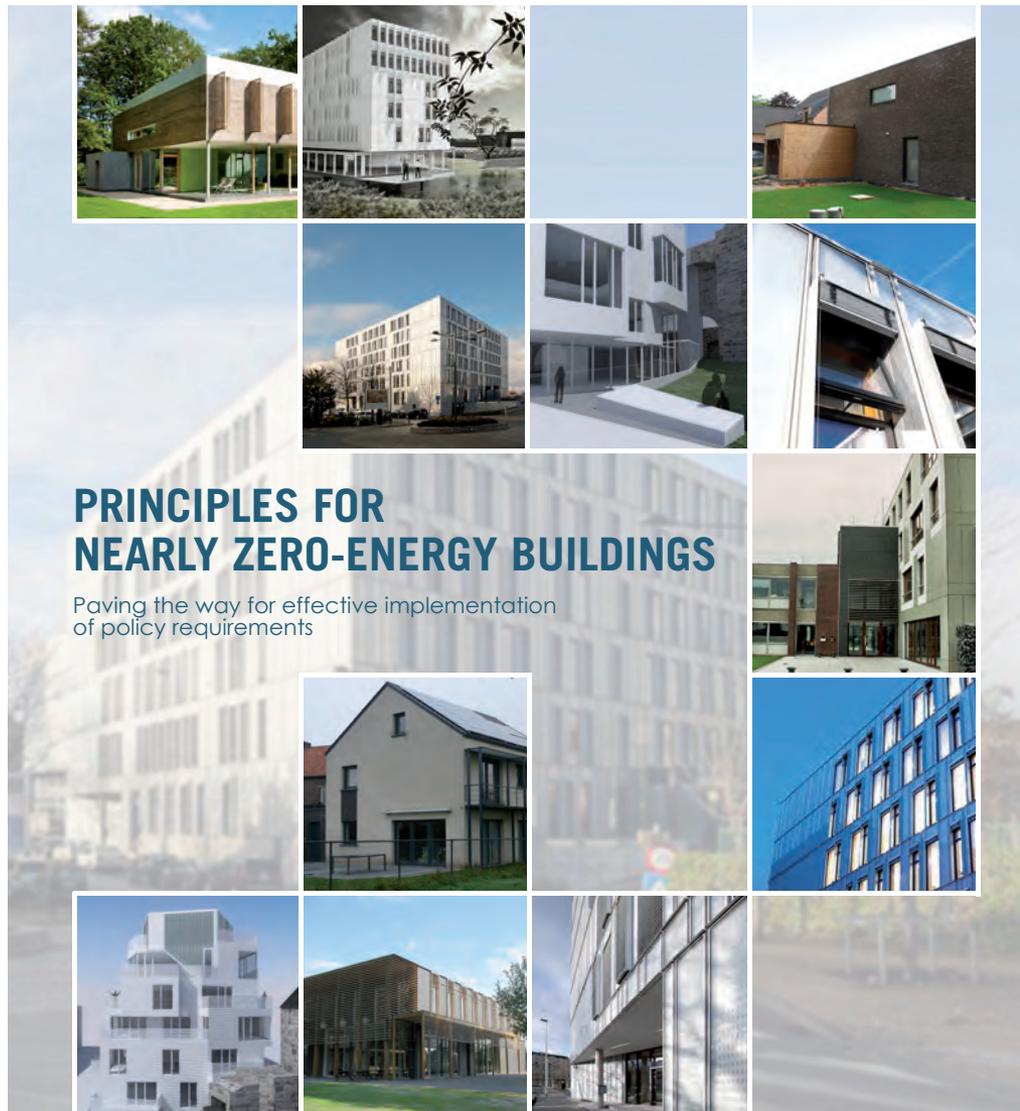
MASSACHUSETTS

BOULDER

AUSTIN

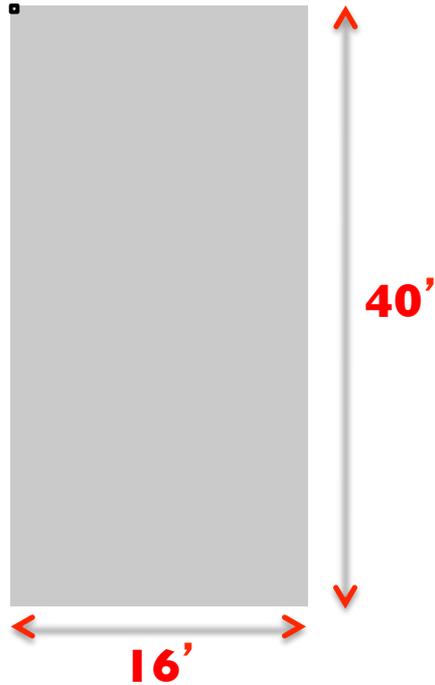
SEATTLE

BRUSSELS 2014

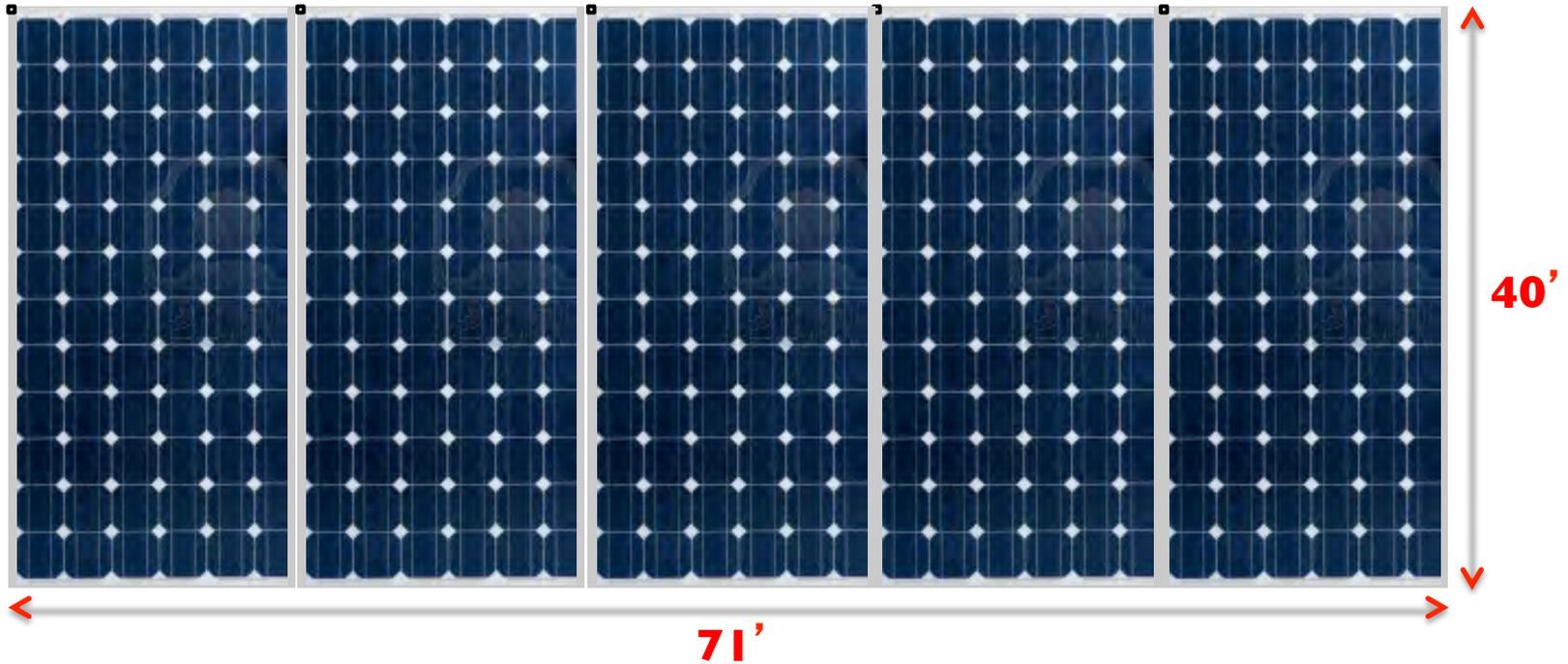


NET-ZERO-ENERGY-CAPABLE

A building must GENERATE
NET-ZERO-ENERGY-CAPABLE
ALL it needs to survive



1900 sf home
39,000 kWh/yr
\$360.00/month



1900 sf home
39,000 kWh/yr
\$360.00/month
2832 sf roof



40'

16'

80% REDUCTION



8550 kWh/yr

615 sf roof



40'

16'



80% REDUCTION

4.5 kWh/sf/yr



Consumption

PH METRIC

4.5 kWh/sf/yr

(Site Energy)



16'



40'

Production

ROOF METRIC

4.5 kWh/sf/yr

(Site Energy)



30°

**PASSIVE
HOUSE
EXTERIOR**

PF	0.91
refl. T	68.0°
dist	3.3ft
COV	25°
rel. H	50%
atm. T	68.0°

EXTERIOR TEMPERATURE

@ 25°

56.9

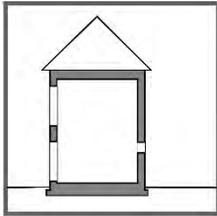
30.2



57°

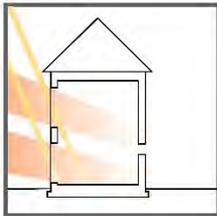
**STANDARD
BUILDING
EXTERIOR**

PASSIVE HOUSE STRATEGIES



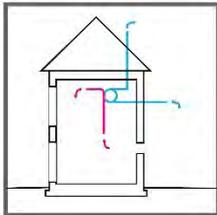
ENVELOPE

AIR TIGHT AND SUPER INSULATED



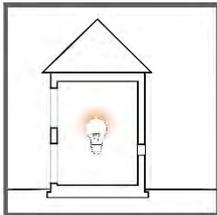
SOLAR ORIENTATION

OPTIMIZE HEAT GAIN



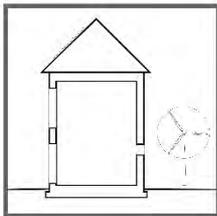
VENTILATION

WITH HEAT RECOVERY



EFFICIENCY

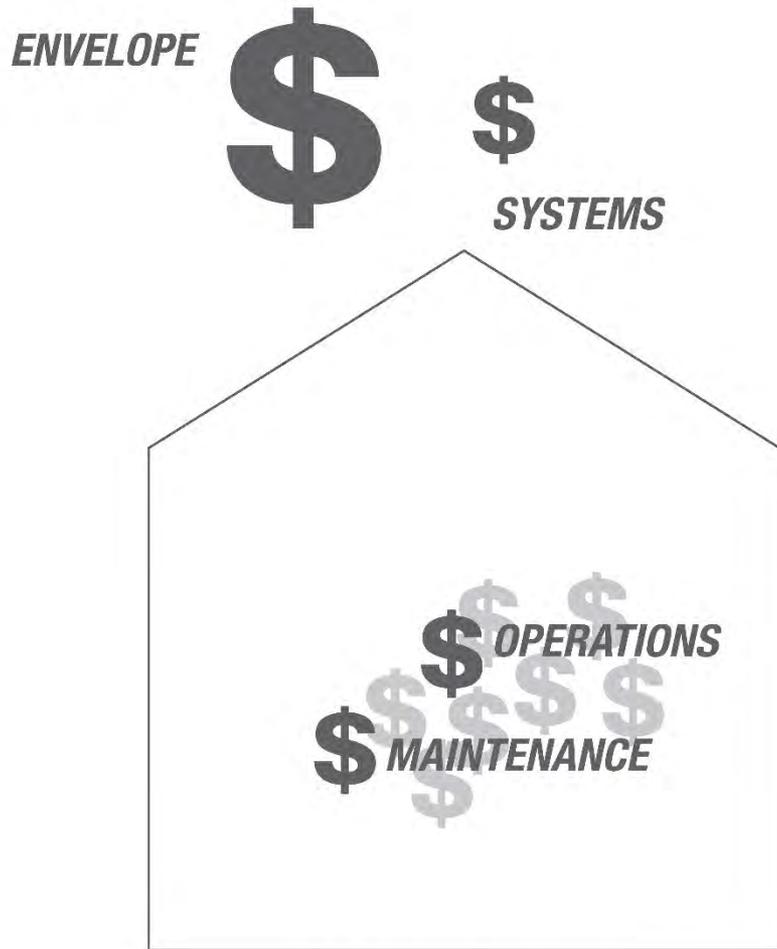
ENERGY SAVING APPLIANCE



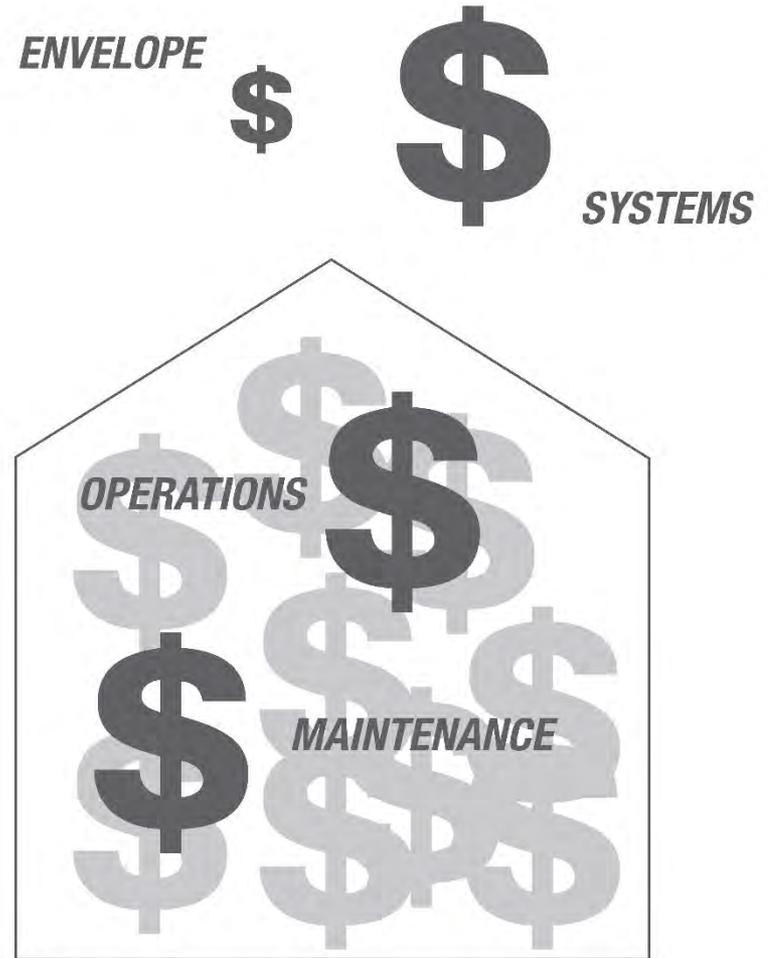
RENEWABLE ENERGY

A VIABLE OPTION

WHERE THE MONEY IS GOING



PASSIVE HOUSE



CONVENTIONAL BUILDING

PASSIVE HOUSE CRITERIA

- 1.** HEATING DEMAND *4.75 kBTU/(FT² YR) MAXIMUM*
- 2.** COOLING DEMAND *4.75 kBTU/(FT² YR) MAXIMUM*
- 3.** BLOWER DOOR TEST *0.6 ACH₅₀*
- 4.** PRIMARY ENERGY *38.0 kBTU/(FT² YR) MAXIMUM* **4.5 kWh/sf/yr**



MODELED IN PASSIVE HOUSE PLANNING PACKAGE (PHPP) OR WUFI PASSIVE

PASSIVE HOUSE CRITERIA

up to 10 points: PHFA

PASSIVE HOUSE CRITERIA up to 10 points: PHFA

**PENNSYLVANIA HOUSING FINANCE AGENCY
ALLOCATION PLAN FOR YEAR 2015
LOW INCOME HOUSING TAX CREDIT PROGRAM**

“Up to 10 points may be awarded to those developments which meet Passive House Certification (nationally or internationally) for energy efficiency (See



www.passivehouse.us or

<http://www.passivehouseacademy.com/>



for additional guidance) To qualify for these points, the application must include pre-certification from a Passive House organization. At construction completion, all required third party test results and verifications, including blower door test and commissioning reports, must be submitted to PHFA.”

PASSIVE HOUSE CRITERIA
up to 10 points: PHFA

Pre- CERTIFICATION

1. PHPP: Passive House Planning Package
 - PH energy model
 - Must meet PH energy criteria
2. Budget reflecting PH design

CERTIFICATION

1. Blower door test
2. 3rd party verifications, test, reports

LEED VERSUS PASSIVE HOUSE COST & PROCESS



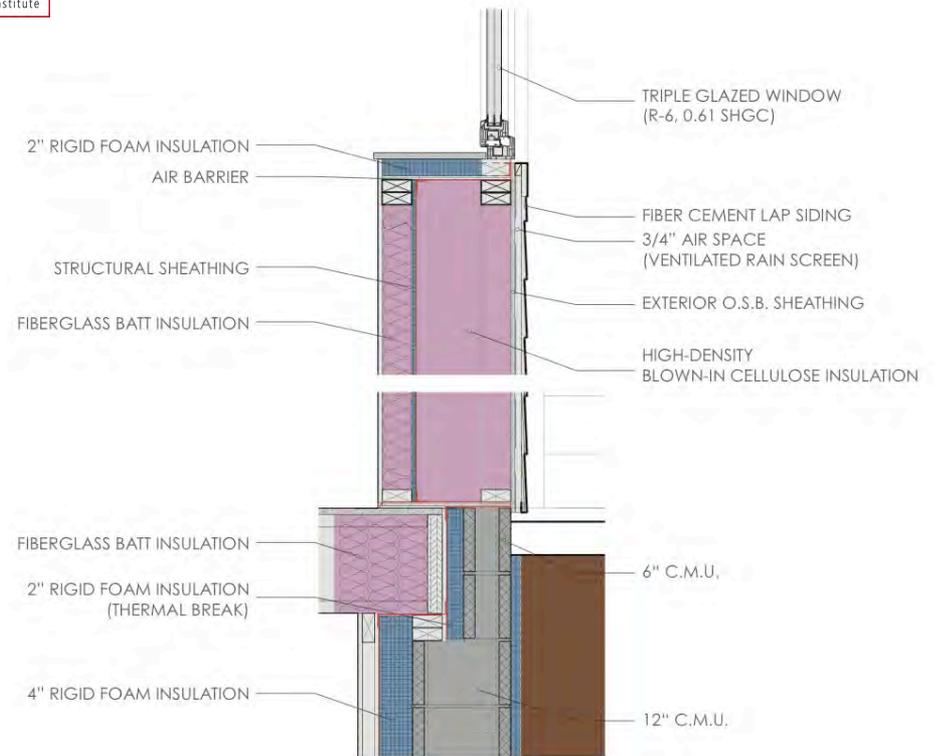
DEEP DIVE INTO ENERGY

PERFORMANCE vs. PRESCRIPTIVE

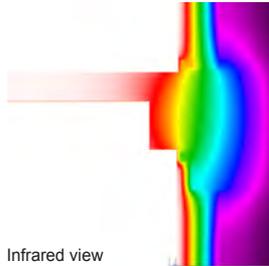
THIRD PARTY VERIFICATION

COMMISSIONING

FEWER CHECKLISTS

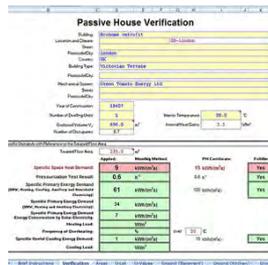


LEED VERSUS PASSIVE HOUSE COST & PROCESS



Infrared view

NO ADDITIONAL COST FROM THE ARCHITECT UNLESS THEY ARE BUILDING THE ENERGY MODELS

A screenshot of the Passive House Verification software interface. The window title is "Passive House Verification". It shows various input fields and a table of results. The table has columns for "Requirement", "Value", "Unit", "Limit", and "Status".

Requirement	Value	Unit	Limit	Status
Specific Space Heat Demand	8	W/m²	10 kWh/m²	Yes
Space Heating Time Demand	0.5	h	10 kWh/m²	Yes
Space Heating Energy Demand	61	kWh/m²	100 kWh/m²	Yes
Space Heating Peak Demand	34	W/m²	100 W/m²	Yes
Space Heating and Cooling Energy Demand	7	kWh/m²	10 kWh/m²	Yes
Space Heating and Cooling Peak Demand	1000	W/m²	1000 W/m²	Yes
Space Heating and Cooling Energy Demand	1	kWh/m²	10 kWh/m²	Yes
Space Heating and Cooling Peak Demand	1000	W/m²	1000 W/m²	Yes

DESIGN- COST OF THE ENERGY MODEL TYPICALLY ABOUT 10% OF THE ARCHITECTURAL FEE

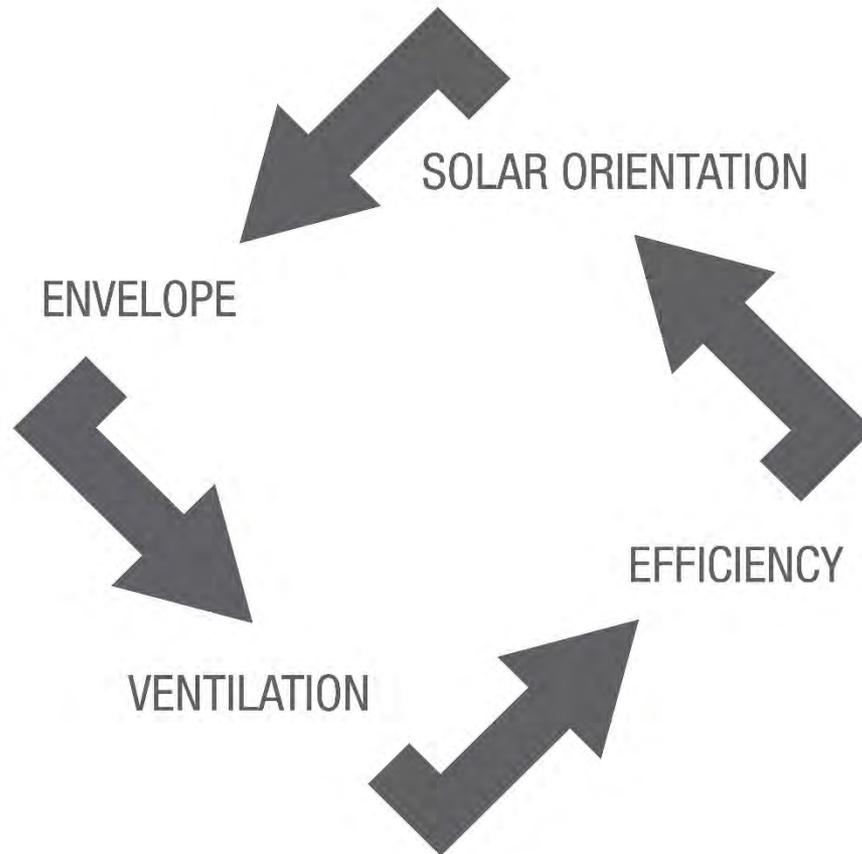


CONSTRUCTION- COST NEUTRAL TO SLIGHTLY MORE IN HOUSES AS MUCH AS 10%



THIRD PARTY- \$3,000 TO \$15,000 FOR PROJECTS RANGING IN SIZE FROM \$250,000 TO \$8,000,000

NOT À LA CARTE





YMCA BEFORE

MCKEESPORT YMCA





Denmarsh Photography, Inc.



Denmarsh Photography, Inc.



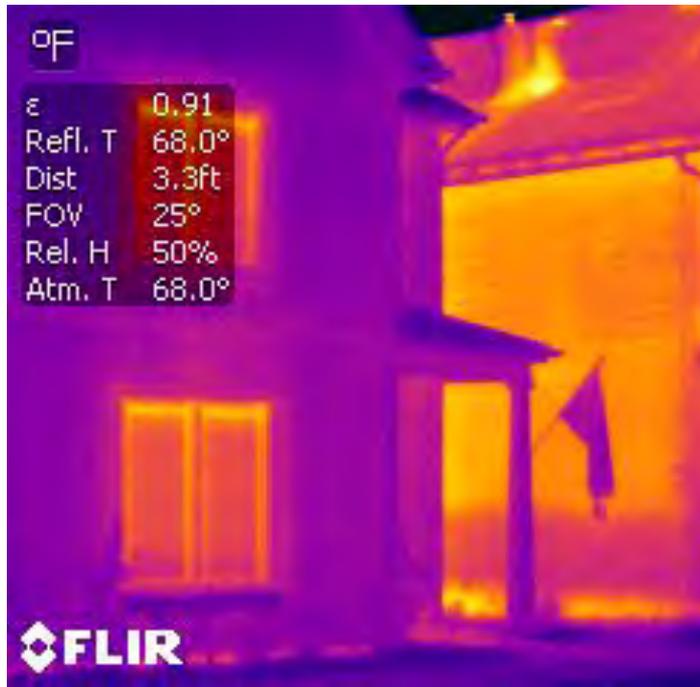
Denmarsh Photography, Inc.

MCKEESPORT DOWNTOWN HOUSING \$119 PER SF





HEIDELBERG PROTOTYPE HOUSE \$135 PER SF



thoughtful
balance^{inc}
sustainable architecture and design



BELFIELD TOWNHOMES Philadelphia

3 – 1920 sf 5 bed
HUD, SHP funding
\$130sf hard costs





ENERGY/BUILDING CONSULTANTS & ENGINEERS
One Crescent Drive • Philadelphia, PA 19112 • 1-888-MAGRANN • www.magrann.com
New Jersey • Pennsylvania • Kentucky • Ohio

BUILDING LEAKAGE TEST COMPARISON

Test #1	Test #2
Test File: Depressurization File	Test File: Pressurization File
Date of Test: 7/5/2012	Date of Test: 7/5/2012
Customer: Onion Flats, LLC 111 West Norris Street Philadelphia, Pennsylvania 19122	Customer: Onion Flats
Phone: 215-783-5591	

Test Results

	Test #1	Test #2	Change	Percent
1. Airflow at 50 Pascals:	293 CFM	201 CFM	-92 CFM	-31.4 %
	0.48 ACH	0.33 ACH	-0.15 ACH	-31.4 %

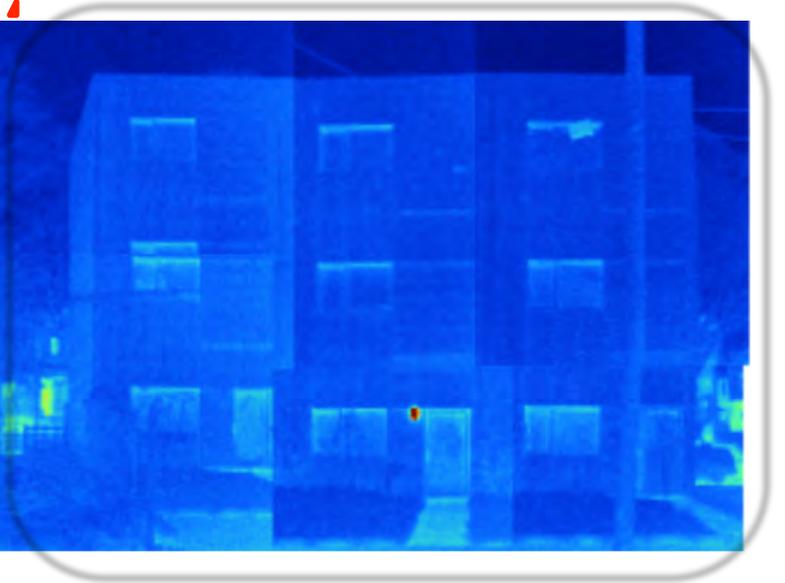
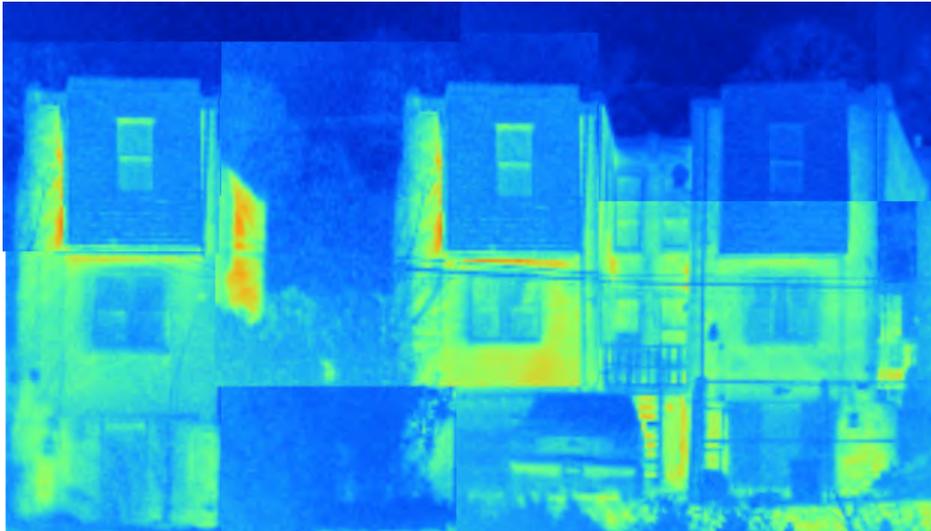
FINAL AIRFLOW:

0.405 ACH 50

PASSIVE HOUSE MAX

0.6 ACH 50





FIRST CERTIFIED PASSIVE HOUSE IN PA

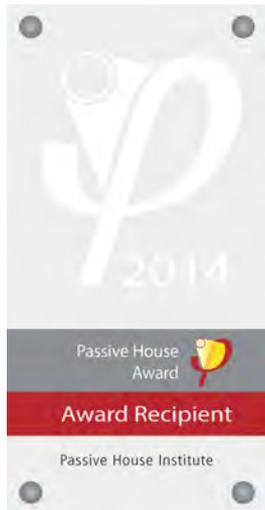


START: APRIL 20, 2012

CERTIFICATE OF OCCUPANCY: JULY 20, 2012

RECIPIENT OF THE

2014 INTERNATIONAL PASSIVE HOUSE AWARD



ONION
FLATS

NORTH PHILADELPHIA HOUSING PROJECT



ENERGY STAR 3

NORTH PHILADELPHIA HOUSING PROJECT



ENERGY STAR 3

to

PASSIVE HOUSE?

NORTH PHILADELPHIA HOUSING PROJECT



ENERGY STAR 3

to

PASSIVE HOUSE?

SAME COST???????

REVISED SITE DESIGN



- 1 **UNIT TYPE 1:**
(3)1-BED FLATS (MODULAR)
- 2 **UNIT TYPE 2:**
(3)2-BED FLATS (MODULAR)
- 3m **UNIT TYPE 3M:**
3-BED TOWNHOME (MODULAR)
- 3 **UNIT TYPE 3:**
3-BED TOWNHOME (SITE-BUILT)
- 3R **UNIT TYPE 3R:**
3-BED TOWNHOME (REHAB)
- 4 **UNIT TYPE 4:**
4-BED TOWNHOME (SITE-BUILT)

REVISED SITE RENDERING



ORIGINAL DESIGN

	UNIT TYPE		ADA	AREA		NUMBER
				NET	GROSS	
REHAB	3 BED	3 STORY		1738	1930	1
TYPE A	3 BED	3 STORY		1327	1503	9
TYPE B	2 BED	1 STORY	(ADA)	1000	1227	5
	2 BED	2 STORY		1064	1126	10
TYPE C	1 BED	1 STORY	(ADA)	742		6
	2BED	2 STORY		1016		6

37

TOTAL 1 BED	6	6			
TOTAL 2 BED	21	5			
TOTAL 3 BED	10				
TOTAL UNITS	37	11	40,698	44,948	

16%

57%

27%

CONSTRUCTION BUDGET ESTIMATE:

\$8,100,000

\$180 /SQFT

\$180 /SQFT

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TYPE 2A	2 BED	FLAT	Y*	966	1,120	7
TYPE 2B	2 BED	FLAT	Y*	990	1,240	7
TYPE 3M	3 BED	3 STORY	N	1,391	1,611	3
TYPE 3 - DIAMOND	3 BED	3 STORY	N	1,327	1,503	6
TYPE 4 - DIAMOND	4 BED	3 STORY	N	1,479	1,656	2
REHAB - 15TH SOUTH	3 BED	3 STORY	N	1,476	1,660	2
REHAB - DIAMOND	3 BED	3 STORY	N	1,738	1,930	1

39

TOTAL 1 BED	11	5	7,337	7,840	28%
TOTAL 2 BED	14	3	13,692	16,520	36%
TOTAL 3 BED	12		16,825	19,101	31%
TOTAL 4 BED	2		2,958	3,312	5%
TOTAL UNITS	39	8	40,812	46,773	

CONSTRUCTION BUDGET ESTIMATE: \$8,077,000 \$173 /SQFT

◀ 28 PASSIVE HOUSE UNITS

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◀ 28 PASSIVE HOUSE UNITS

\$173 /SQFT



STABLES, 2014: 27 Passive House, Modular and site-built townhomes



MODULAR
PASSIVE HOUSE

SITE-BUILT
PASSIVE HOUSE
ALTERED FLOOR PLAN

SITE-BUILT
TWO LOTS MERGED
NOT PASSIVE HOUSE

SITE-BUILT
DIFFERENT DEVELOPER
NOT PASSIVE HOUSE
BUT SAME ENVELOPE









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FINAL AIRFLOW **.49 ACH 50**









RIDGE FLATS, 2015: 147 Passive House, Modular rental units and retail



RIDGE FLATS 2, 2016: 150 Passive House, Modular rental units and retail



VIEW FROM CORNER OF KELLY DR & CALUMET ST. LOOKING NORTH

**THANK
YOU**

Tim McDonald, Temple University, Onion Flats, Philadelphia

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Laura Nettleton, Thoughtful Balance, Pittsburgh

laura@thoughtfulbalance.com