THE NEW GRAVITY

Climate Change and the Imperative of High Performance Affordable Housing

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Toykyo's Levitating Girl, Natsumi Hayashi

ONION FLATS
DEVELOPMENT

ONION FLATS
ARCHITECTURE

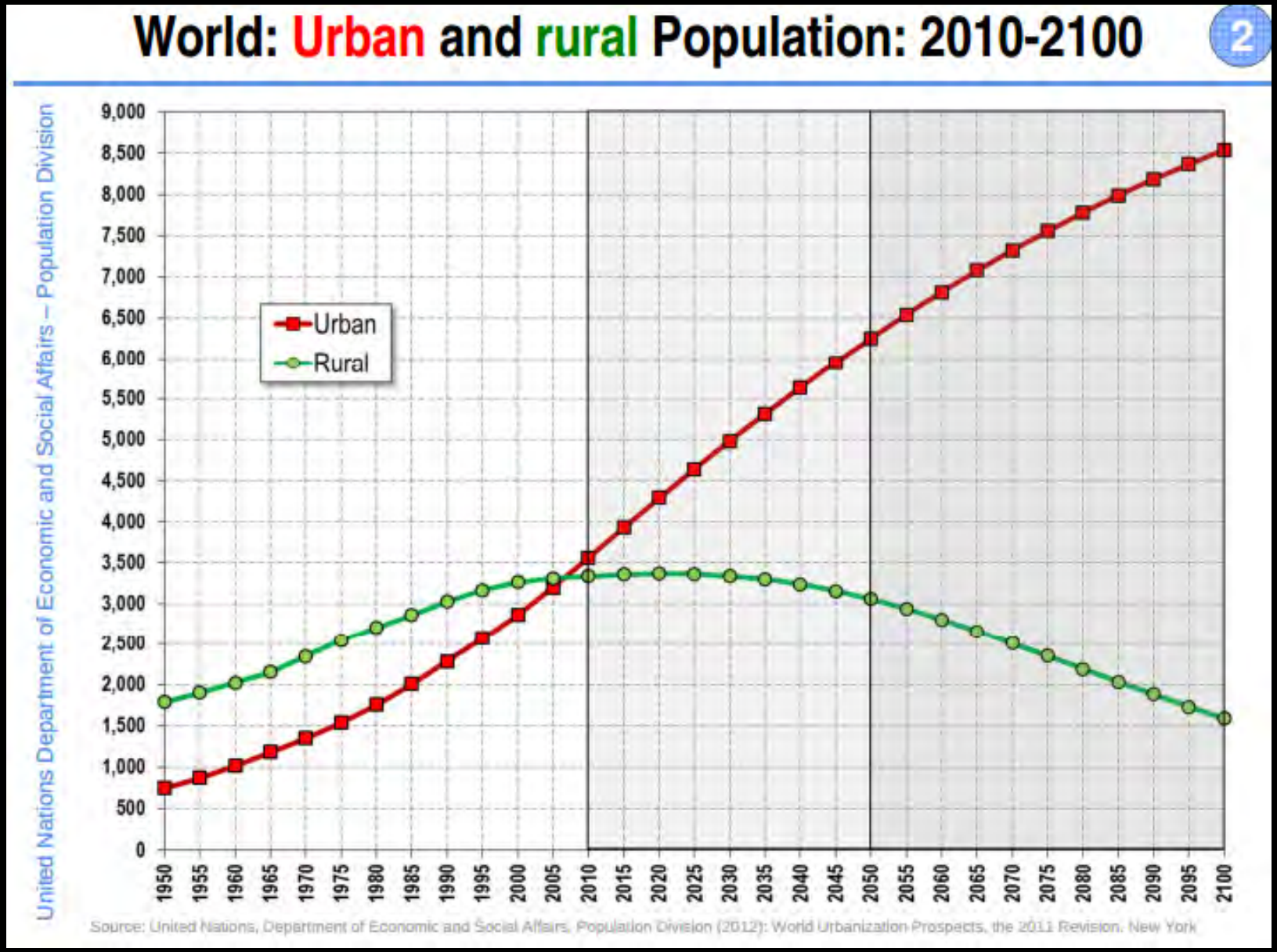
ONION FLATS
CONSTRUCTION

GREEN ROOFS
GRASS
SOLAR SYSTEMS

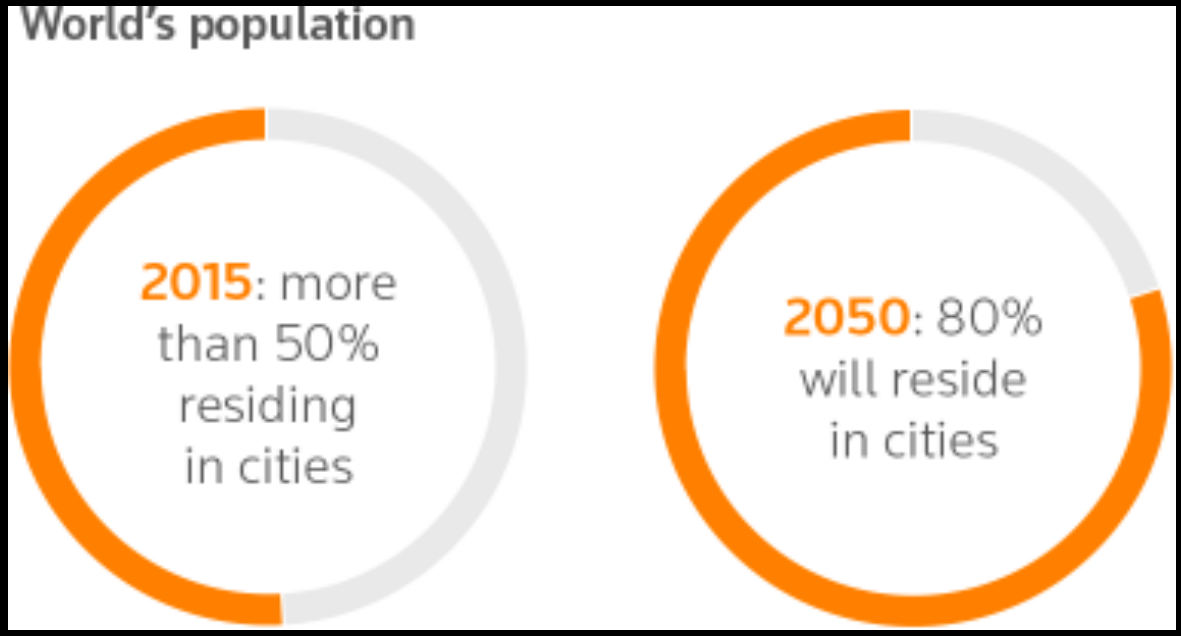
Ed Mazria, Greenbuild Philly 2013

Ed Mazria, Greenbuild Philly 2013

World: Urban and rural Population: 2010-2100



United Nations, Department of Economic and Social Affairs, 2012



Thomson Reuters, 2017

Ed Mazria, Greenbuild Philly 2013

THE NEW GRAVITY

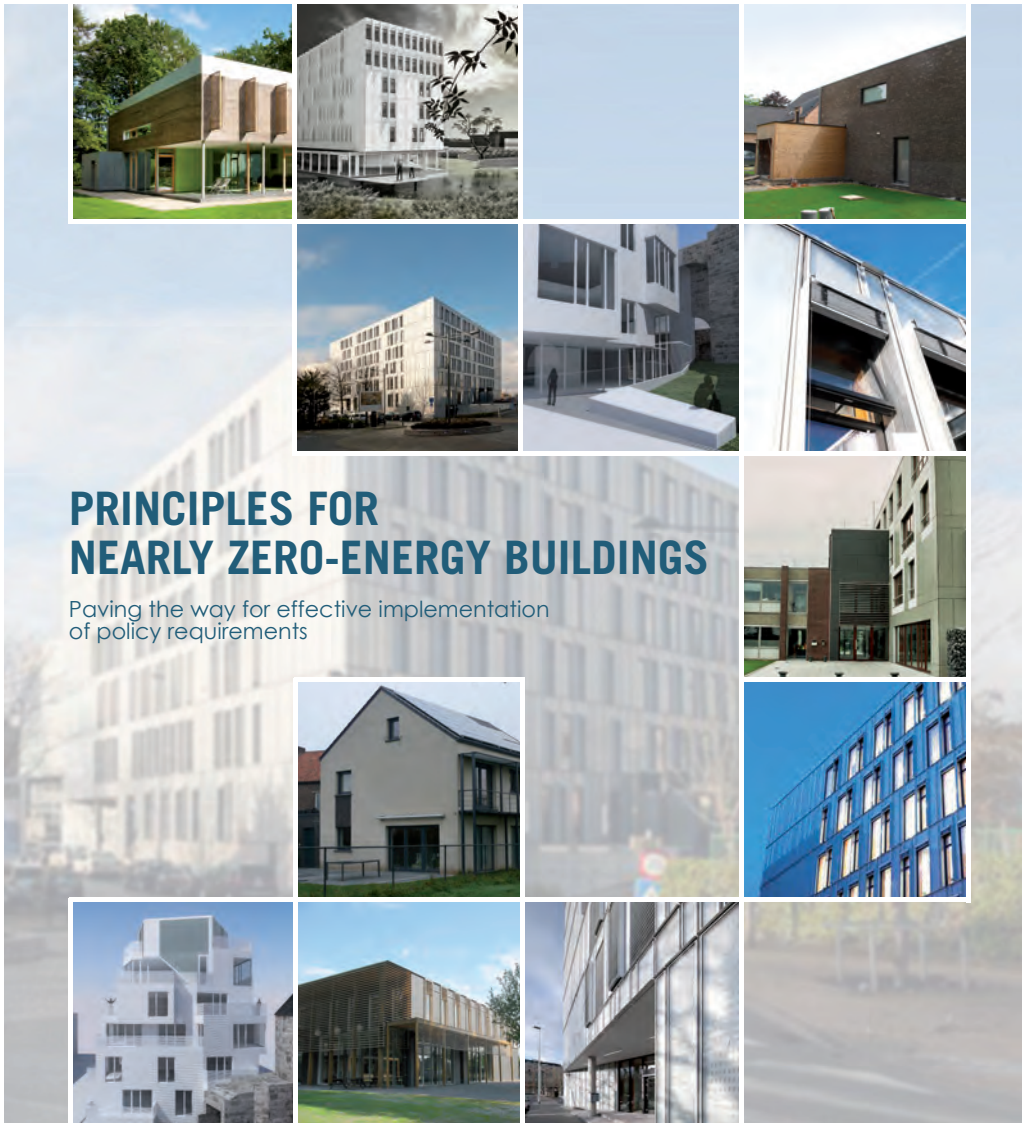
RADICAL

AFFORDABLE

SCALABLE

BRUSSELS 2015

"….calls for all buildings to be Nearly-Zero Energy Buildings by the end of 2020…. Brussels' new regulation is based on the Passive House Standard, making it mandatory for all new builds as well as all retrofits as of January 2015." IPHA



BPIE

Mayor de Blasio Commits to 80 Percent Reduction of Greenhouse Gas Emissions by 2050, Starting with Sweeping Green Buildings Plan

September 21, 2014

UTAH

Park City Passes Resolution to Adopt Net-Zero Energy Performance Requirements for Municipal Buildings and Facilities

Resolution is first of its kind in North America

PARK CITY, Utah (October 16, 2017) – The City Council of Park City, Utah, unanimously passed Resolution 28-2017 to adopt net-zero energy performance requirements for all new buildings and facilities constructed using municipal funds. The resolution is the first of its kind in North America.

"It is with great pride that our Council passed this resolution to require our new and renovated buildings and facilities to have minimal environmental impacts," said Park City Mayor, Jack Thomas. "We want Park City to showcase that we can, and must, take meaningful action to address the climate crisis. Our future depends on it."

Net-zero energy performance, with an emphasis on energy efficiency, will be incorporated from the beginning of the design process of all municipal buildings and facilities. Actual energy use will be measured for one year post-occupancy to ensure that the building performs to the standard it was designed. Additionally, the Resolution requires renewable energy to be produced on site to cover the facility's annual need, as opposed to purchasing off-site credits.

Energy modelers and commissioning agents will be involved at the earliest stages of design and pre-design to recommend methods to capture efficiencies, as well as to ensure all mechanical systems are appropriately sized and work together to magnify energy savings. This proven process results in capturing efficiencies, which leads to significant financial savings over the lifetime of the facility.

The resolution also outlines verification pathways to prove that buildings and facilities use net-zero, fossil-based energy. Acceptable verification standards include the International Living Future Institute's Energy Petal certification; a score of zero on the Zero Energy Performance Index; and Passive House certification with on-site renewables.

Building Code Revision Launches California Toward Zero Net Energy Buildings

Bill Roth | Monday November 11th, 2013 | 2 Comments

Starting in 2014, California is implementing a tsunami of building code revisions called Title 24. These revised building codes will move California's residential and commercial buildings toward Zero Net Energy (ZNE). In a ZNE building, the annual energy consumption is equal to its annual production of renewable energy. Under Title 24, all new residential construction is to be ZNE by 2020 with all new commercial buildings achieving this ZNE goal by 2030.

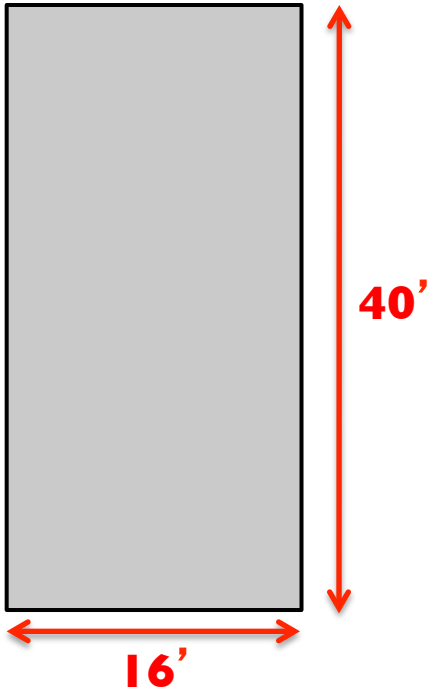
Title 24 moves building design toward "comprehensive building solutions." This building design approach first focuses upon reducing energy consumption through the integration of smart and energy efficient technologies. The final design step after reducing the building's energy consumption is to install onsite renewable energy generation like solar panels.

NET-ZERO-ENERGY-CAPABLE

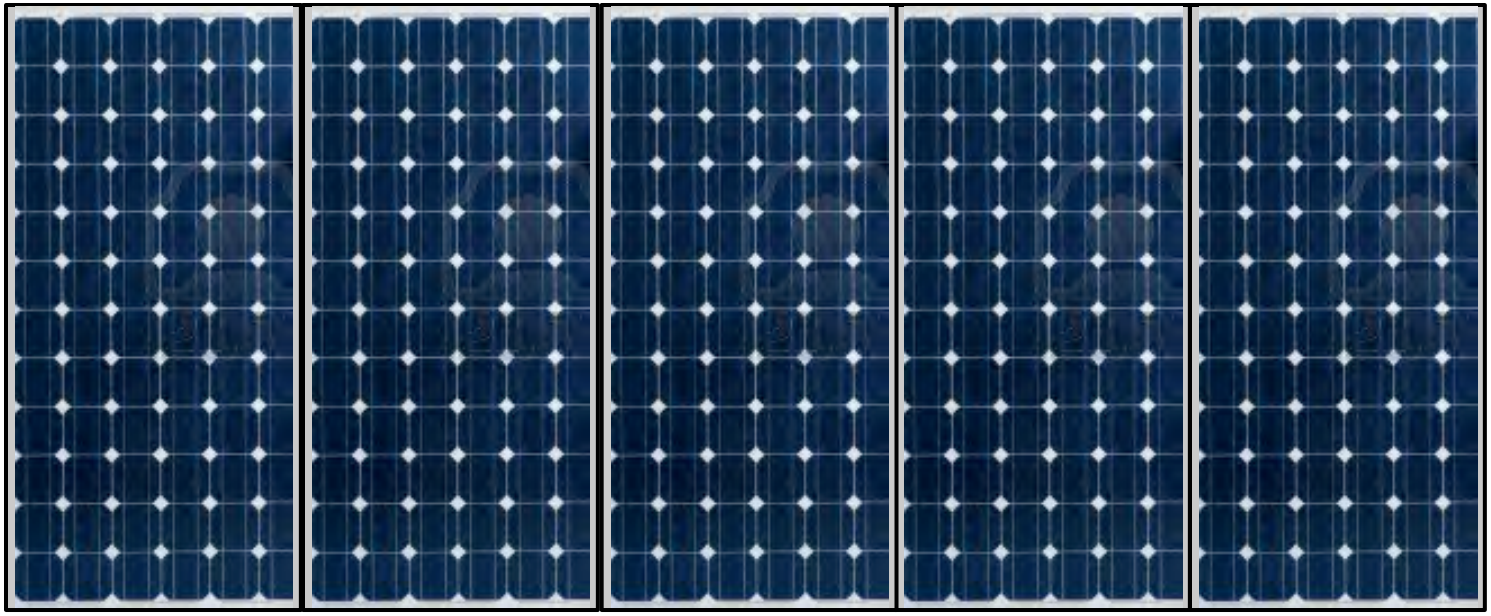
A building must GENERATE

NET-ZERO-ENERGY-CAPABLE

ALL it needs to survive
on it's own site



1900 sf home
39,000 kWh/yr



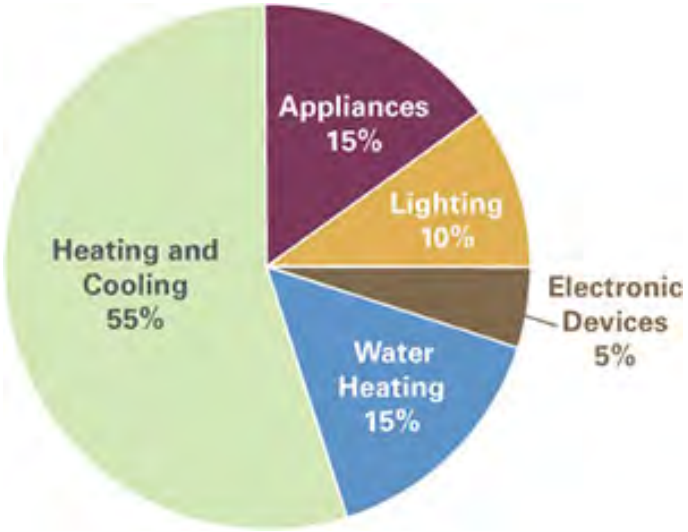
1900 sf home

39,000 kWh/yr

2832 sf roof

80% REDUCTION

4.5 kWh/sf/yr

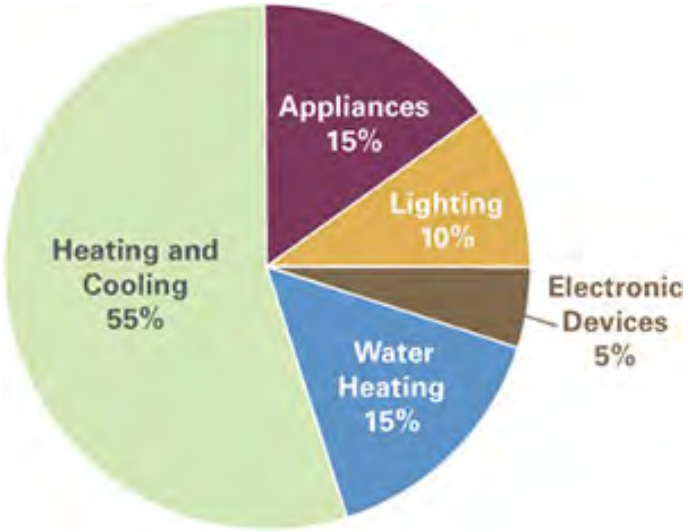


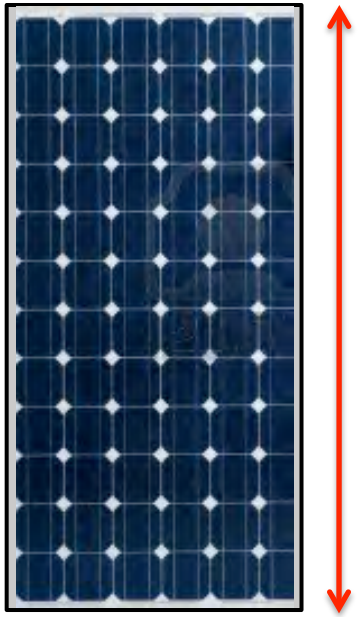
40’

16’

80% REDUCTION

4.5 kWh/sf/yr





80% REDUCTION

4.5 kWh/sf/yr

Certified Passive House
Passive House Institute

PHIUS
Passive House Institute US

"Fabric First" approach

80% REDUCTION

4.5 kWh/sf/yr

Certified
Passive House
Passive House Institute

Envelope and Thermal Comfort Principles

1. **Continuous Insulation-** creating steady indoor temperatures that won't drop below 50 degrees without heating source

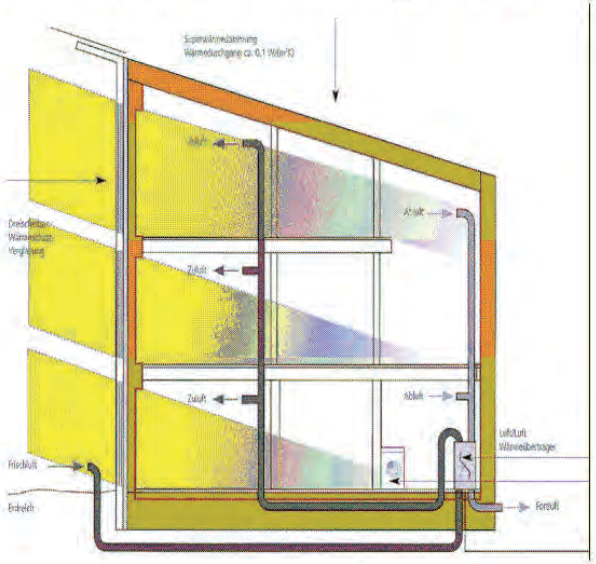
2. **Thermal Bridge Free Construction-** minimizes condensation/ building deterioration

3. **Compact Building Shape-** excellent surface-to-volume ratio (< 1)

4. **Airtightness-** minimizes moisture diffusion into wall assembly

5. **Balanced Ventilation with Heat Recovery with minimal Space Conditioning System -** exceptional efficiency, indoor air-quality and comfort

6. **Optimal Solar Orientation and Shading** – maximizing solar gains for winter, minimizing gains for the summer case



7. **Energy Efficient Appliances and Lighting-** highly efficient use of household electricity

8. **User Friendliness -** user manuals are recommended to be given homeowners

PHIUS
Passive House Institute US

BLDG MPG

PERFORMANCE

Requirements

1. Specific Space Heating/ Cooling Demand	4.75 kBTU/sf/yr
2. Air-Tightness	.6 ACH50
3. Specific Primary Energy Demand	38 kBTU/sf/yr
	4.5 kWh/sf/yr

Certified Passive House
Passive House Institute

PHIUS
Passive House Institute US

Consumption

PH METRIC

4.5 kWh/sf/yr

(Site Energy)

Production

ROOF METRIC

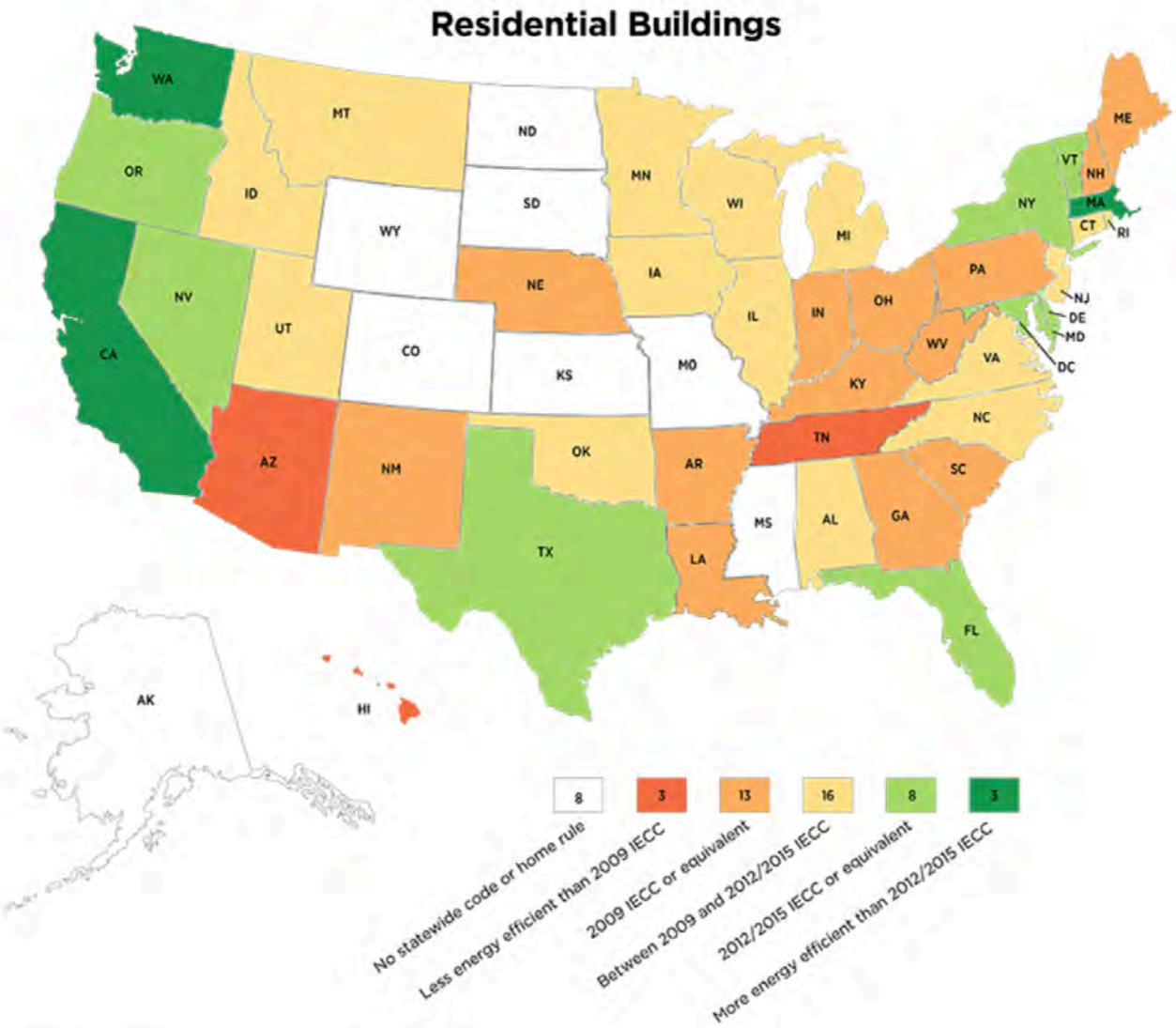
4.5 kWh/sf/yr

(Site Energy)

HOW DO WE GET THERE?

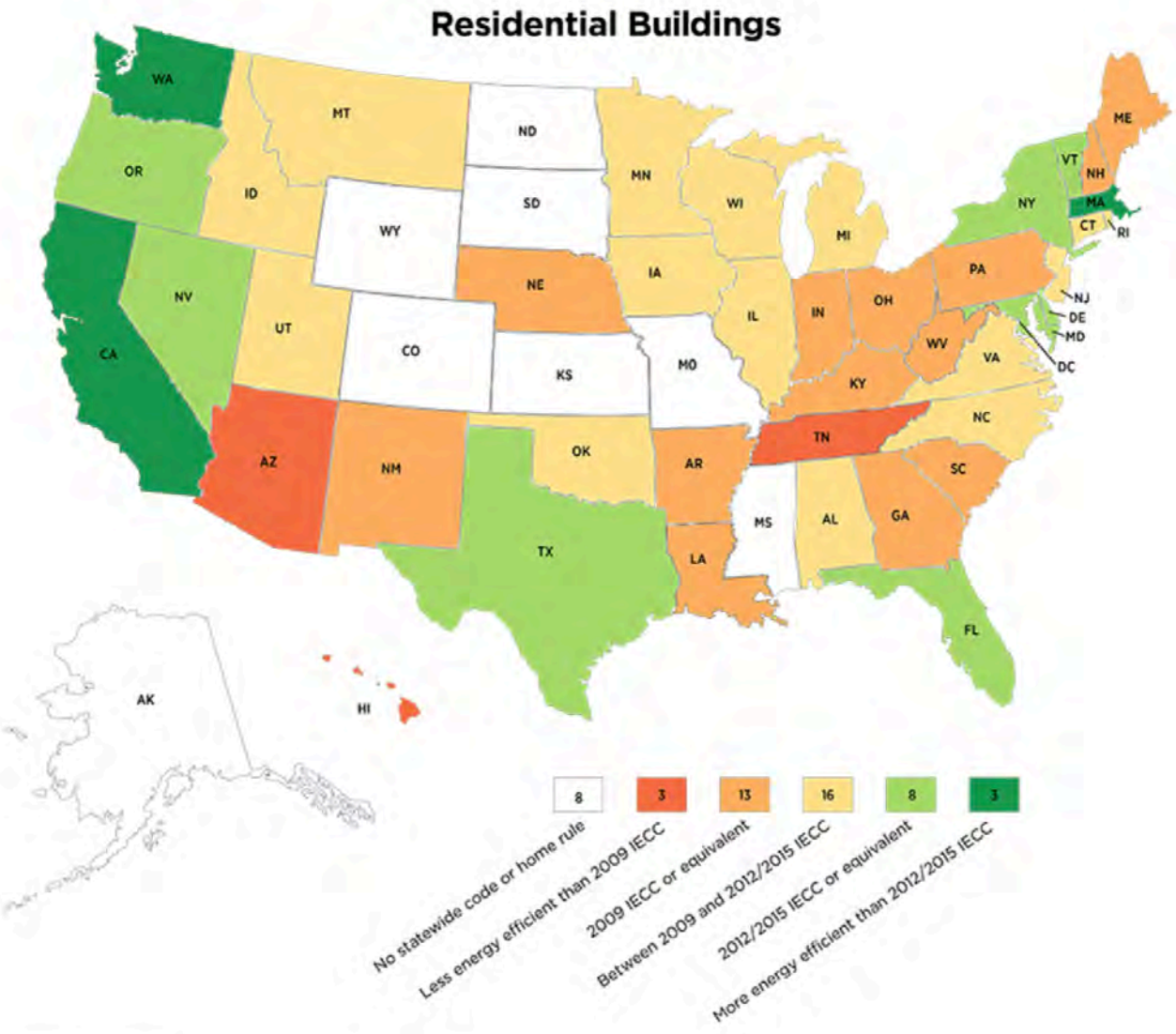
HOW DO WE GET THERE?

1. LEGISLATE it
2. DEMONSTRATE it



Updated as of July 31, 2017

LEGISLATE it?



DEMONSTRATE it!

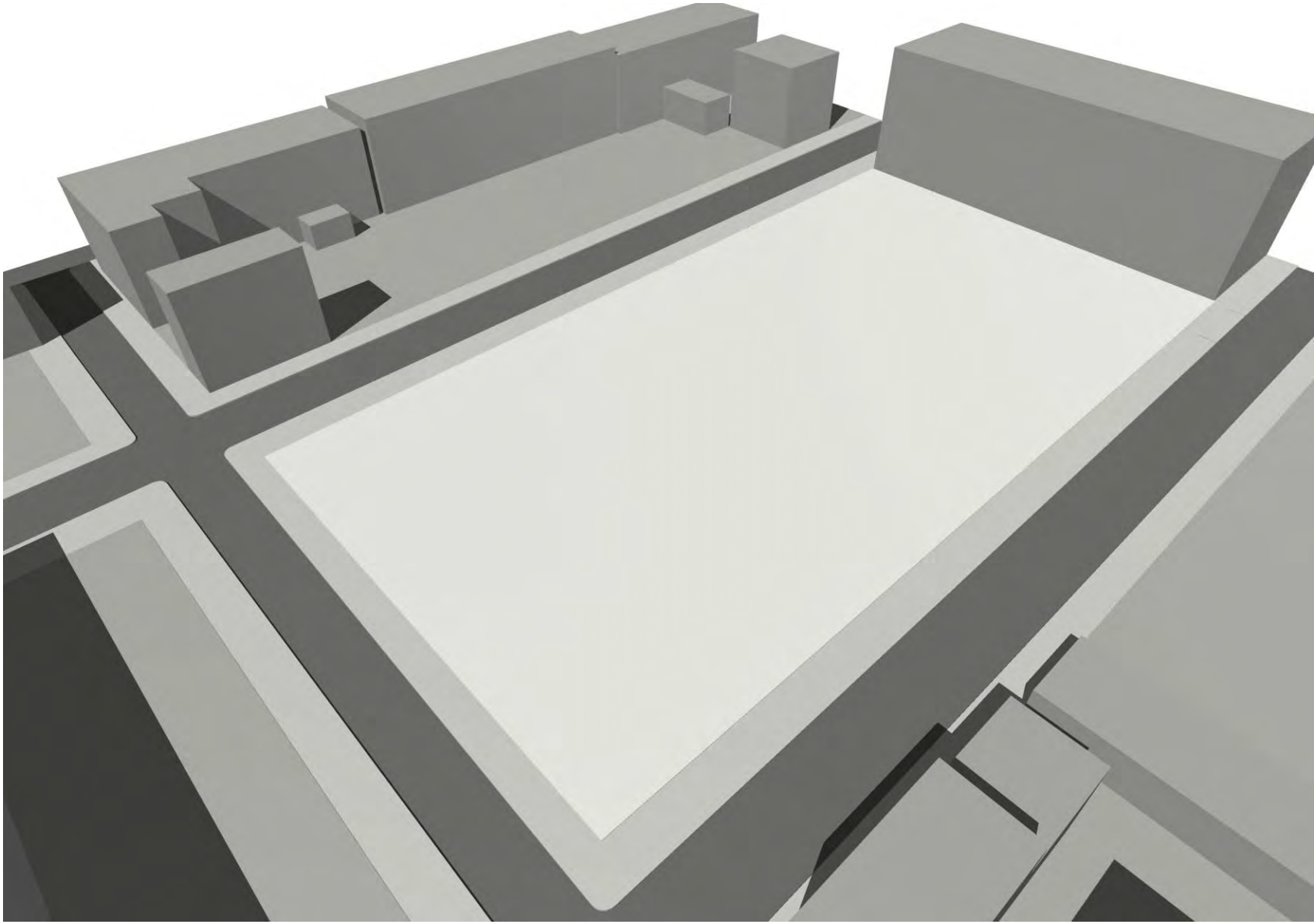
DEMONSTRATE it!

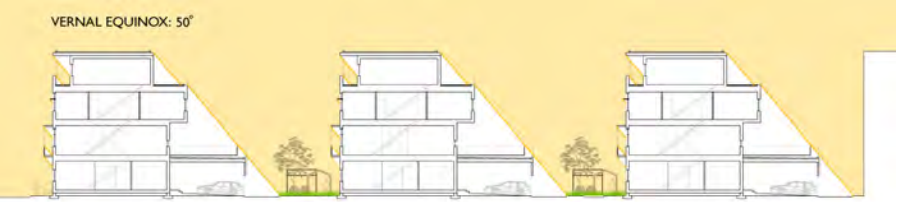
NORRIS SQUARE

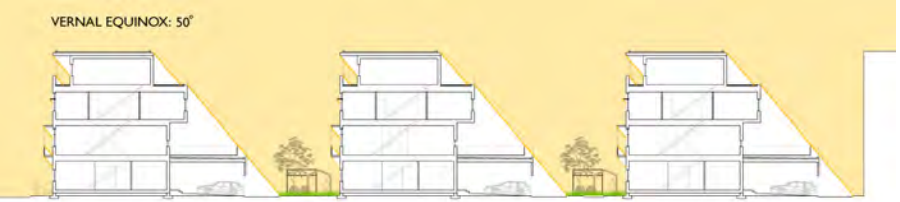
NORTHERN LIBERTIES


NORRIS SQUARE
BANK FLATS
STABLE FLATS
CAPITAL FLATS
NORTHERN LIBERTIES
NORTH PHILADELPHIA EAST
KENSINGTON
BREWERYTOWN
SHARSWOOD
CECIL B. MOORE
YORKTOWN
OLDE KENSINGTON
OLDE RICHMOND
FISHTOWN
SPRING GARDEN
POPLAR
COOPER POINT
OLD CITY
CENTER CITY
Girard College
Eastern State Penitentiary
Philadelphia Museum of Art
The Oval
Barnes Foundation
The Franklin Institute
Drexel University
Pennsylvania Academy of the Fine Arts
Reading Terminal Market
Philadelphia City Hall
Union Transfer
Edgar Allan Poe House
SugarHouse Casino
Race Street Pier
Ben Franklin Bridge
Delaware River
Delaware Expy
Cecil B. Moore Ave
W Girard Ave
E Girard Ave
Fairmount Ave
Spring Garden St
Callowhill St
Race St
Arch St
Market St
Chestnut St
Master St
N Delaware Ave
PENNSYLVANIA
NEW JERSEY
Google

STABLE FLATS 2015: 26 townhomes




VERNAL EQUINOX: 50°


VERNAL EQUINOX: 50°


SUMMER SUN
WINTER SUN
solar electric
solar hot water


BODINE STREET
GEORGE ST
ONE WAY
SOLD

MaGrann ASSOCIATES

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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 **.49 ACH 50**

** 12 Months of Measured Data*

Address	TFA sf	12 Months kWh Total	PV kWh	NET	COST $/Yr	SITE ENERGY kWh/sf/yr
235 George	1908	13,088	4172	8916	$1079	6.8
					$90/m	
PH Certified Passive House		*8586*				4.5
Typical Code Building		40,068	68% BETTER		$4407	21
					$367/m	

Total HARD Construction Costs: $375,000.00 ***$150.00 sf***

ONION FLATS

CAPITAL FLATS : 3 PHASES, 42 UNITS, 18 YEARS

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CAPITAL FLATS : 3 PHASES, 42 UNITS, 18 YEARS

PHASE 1: THE FACTORY: 2001

PHASE 2: THIN FLATS: 2009

FIRST LEED Platinum Duplexes in USA

CAPITAL FLATS : 3 PHASES, 42 UNITS, 18 YEARS

* 24 Months of Measured Data

Address	TFA sf	Electricity kWh Total	Gas MBtu	Gas kWh	Total Energy kWh	SITE (kBTU/TFA) kBTU/sf/yr	kWh/sf/yr
145B W. Laurel	1480	3288	34,374	10,074	**13,362**	**31**	**9**
Measured Air-Tightness: **4.8 ACH50**							
PROJECTED						**37**	**11**
REFERENCE (Code home)						**54**	**16**
Total HARD Construction Costs: $2,880,000.00						***$144.00 sf***	
157 W. Laurel	(2880)2217	14,520	346	1179	**15,700**	**24**	**7**
Measured Air-Tightness: **2.1 ACH50**							
PROJECTED						**41**	**12**
REFERENCE (Code home)						**74**	**22**

PHASE 2: THIN FLATS 2008