

How to Get to Zero Energy in Multifamily

Better Buildings Summit

Ralph DiNola

CEO, NBI

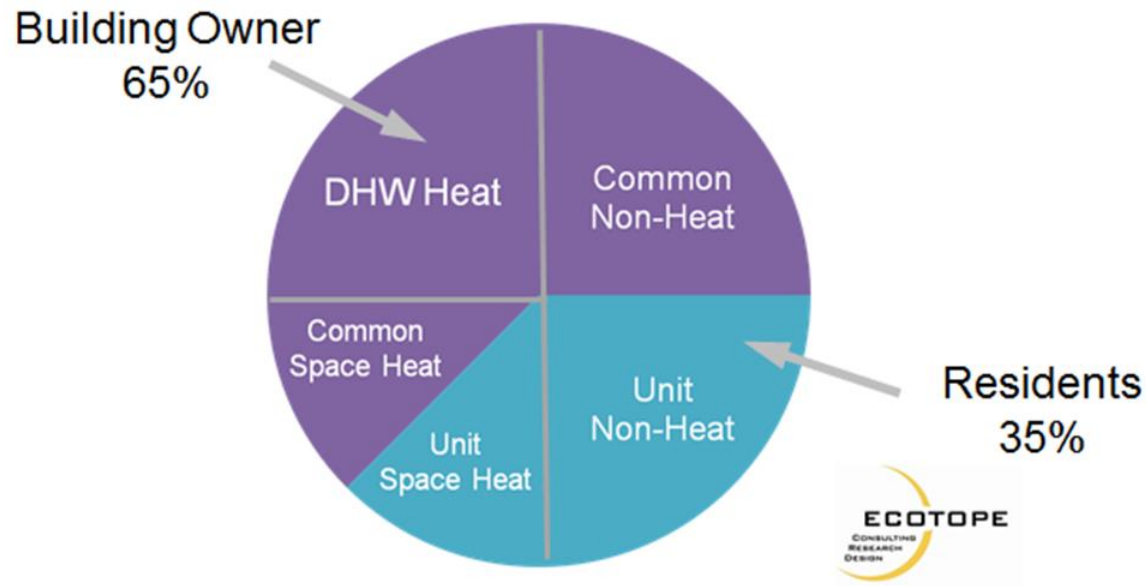
May 27th, 2015

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Market and Policy Context

Multifamily Context

- 24% of the national housing stock
- Large MF buildings are over 30% of units



Zero Net Energy

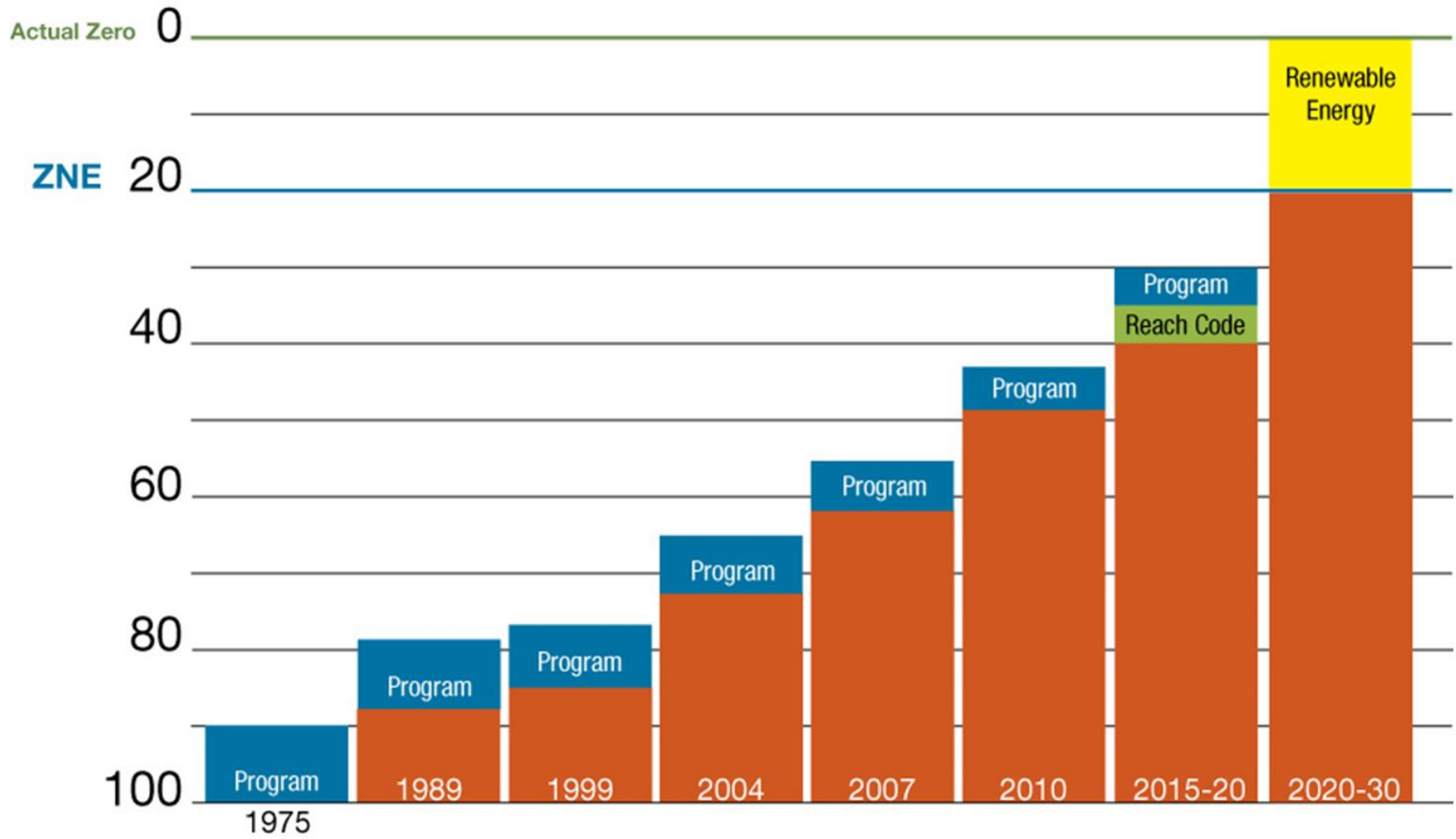
Defined...

Zero Net Energy buildings are buildings with greatly reduced energy load such that, averaged over a year, **100% of the buildings energy use can be met with onsite renewable energy technologies.** *Also known as Net Zero Energy.*

Measured Energy Stats



Advancing Policy to Zero




GETTING TO zero

BUILDINGS DATABASE


New Buildings Institute is proud to introduce
our **Getting to Zero Buildings Database.**

NBI Featured Project




Bullitt Foundation Cascadia Center
Building Type(s): Office
Gross Area: 51,990 ft²
Project Scope:
Completion Date: Apr 2013
[Learn more about this project](#)

Most Popular




Alfred A. Arraj United States District Courthouse
Bradshaw Construction New Office Building
Target New Construction
Target Energy Upgrade
Kohl's Energy Upgrade
[Read More](#)

Most Recent



Lincoln Heritage Public Library - Chrisney Branch
Rinker Hall at the University of Florida
Yale Sculpture Building and Gallery
The Absent House: The Ecological House of Puerto Rico
IDeAs Z Squared Design Facility
[Read More](#)

Featured Views



ZNE Verified
ZNE Emerging
Advanced Buildings
[Submit a Project](#)
Want to contribute? Submit a Project.
Resources:
The Getting to Zero Project Portal is an access point to the DOE's High Performance Buildings Database. For more information on the database [click here.](#)

NBI Getting to Zero Buildings Database

Search Projects: **Search**

ZNE Verified ZNE Emerging
 Advanced Buildings

Net EUI* (kBtu/ft²/yr): At Least Less Than

Building Size (ft²): At Least Less Than





Primary Building Use:

Construction Type:

Climate: - Show All -
State or Province: California

Filter Results

* The Net Energy Use Intensity (EUI) includes both whole-building energy usage and on-site renewable generation and may be modeled (estimated) or measured (actual). ZNE buildings will have an EUI of zero or less (a negative number indicates generation exceeds use). See each project's energy section.

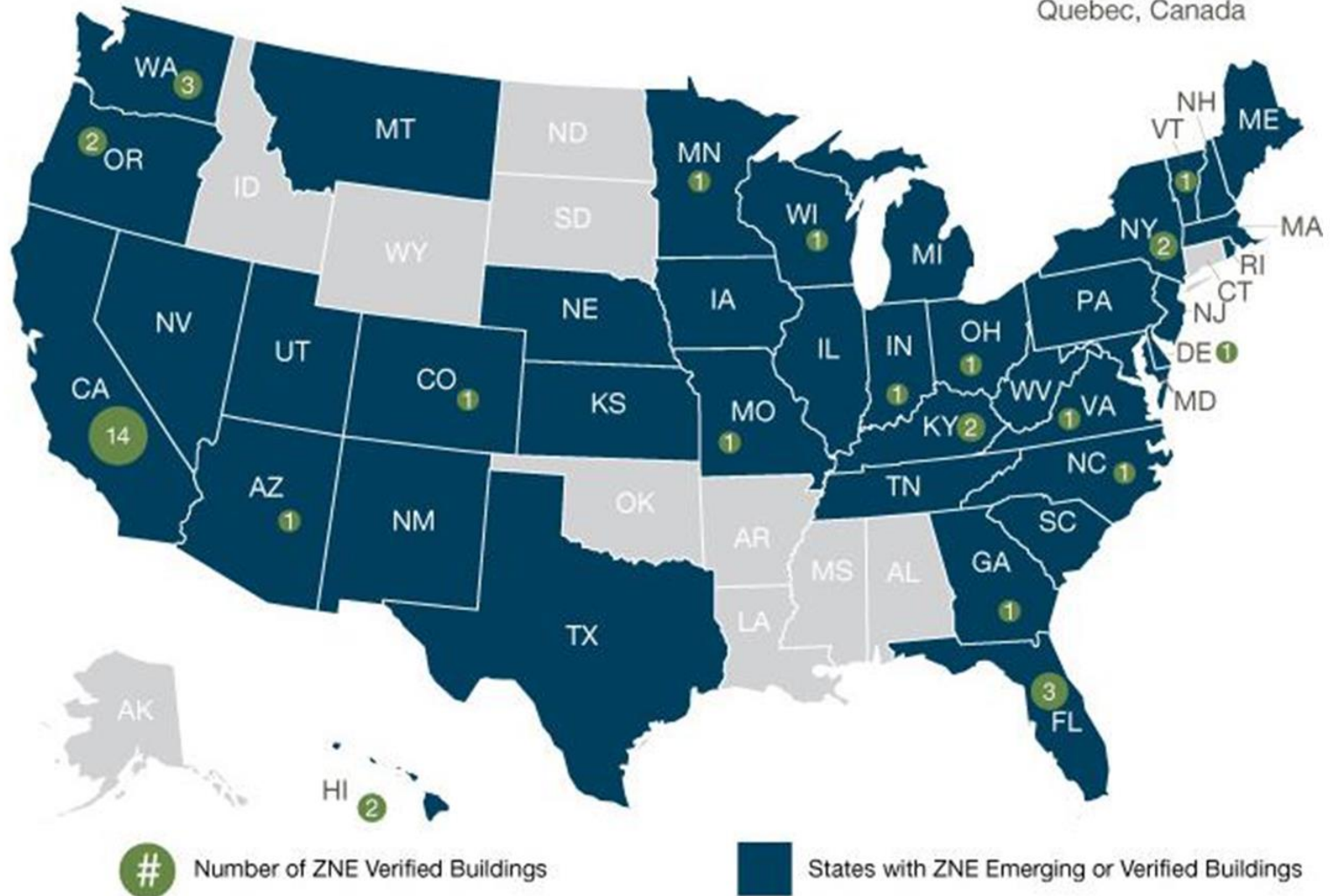
Project Name	City	State	Area (ft ²)	Net EUI (kBtu/ft ² /yr)*
 Audubon Center at Debs Park	Los Angeles	CA	6027	0.00
 Bacon St. Offices	San Diego	CA	4499	-9.53
 Challengers Tennis Club for Boys and Girls	Los Angeles	CA	3498	-0.10
 City of Watsonville Water Resources Center	Watsonville	CA	19795	-54.01
 David and Lucile Packard Foundation	Los Altos	CA	48997	-4.65
 Diamond X Ranch Student Intern Center at Santa Monica National Recreation Area	Malibu	CA	3498	-3.56
 DPR Construction San Diego Net Zero Office	San Diego	CA	33390	-1.19
 Environmental Technology Center at Sonoma State University	Rohnert Park	CA	2196	-1.47
 IDeAs Z Squared Design Facility	San Jose	CA	6555	-0.62
 Leslie Shannon Sun Field Station at Jasper Ridge	Woodside	CA	13107	3.75

The largest database on ZNE buildings in North America and the only database searchable by ZNE Status & Energy Performance
<http://newbuildings.org/getting-to-zero-buildings-database>

40 States with ZNE Buildings

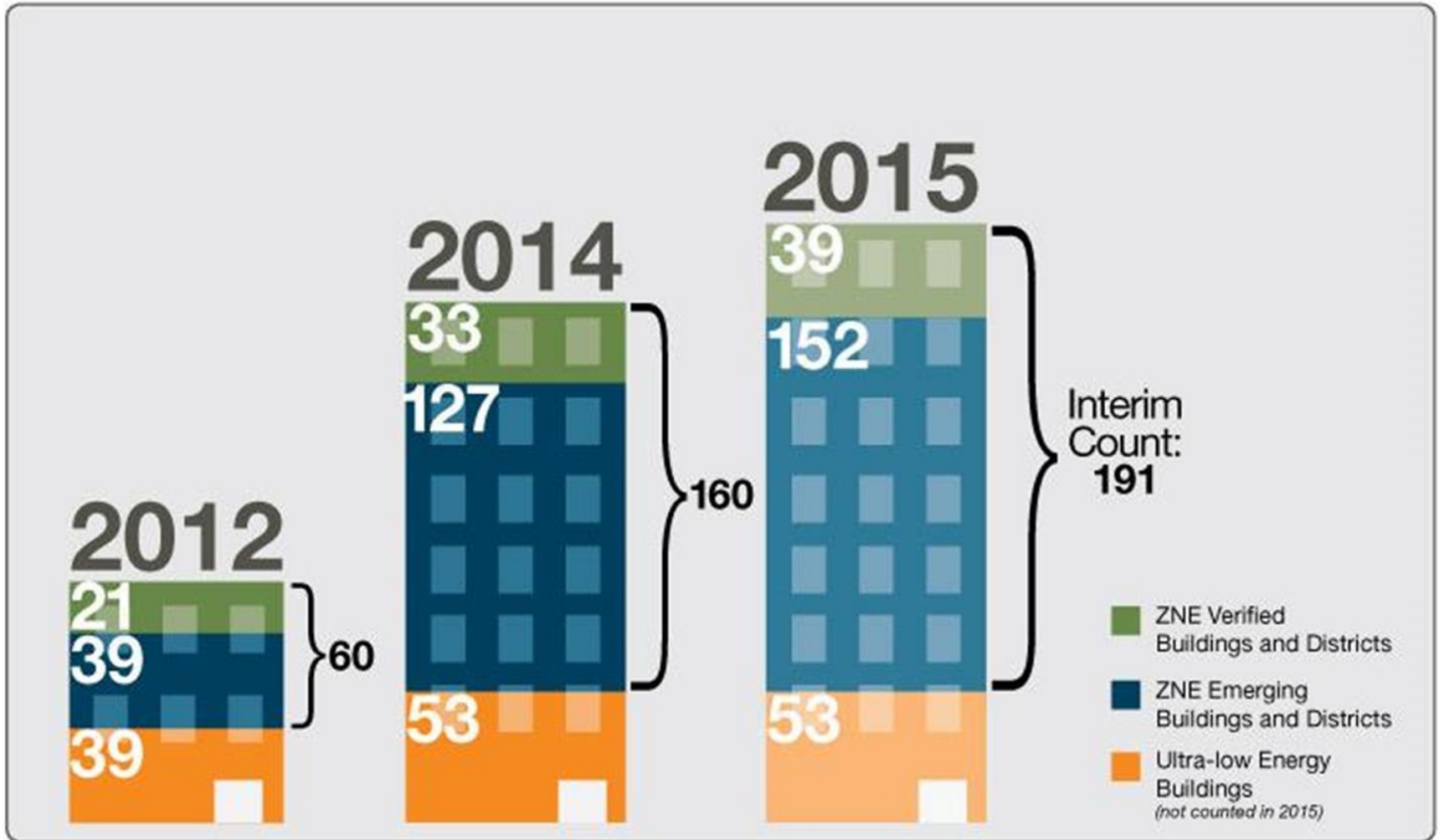
British Columbia, Canada

Quebec, Canada



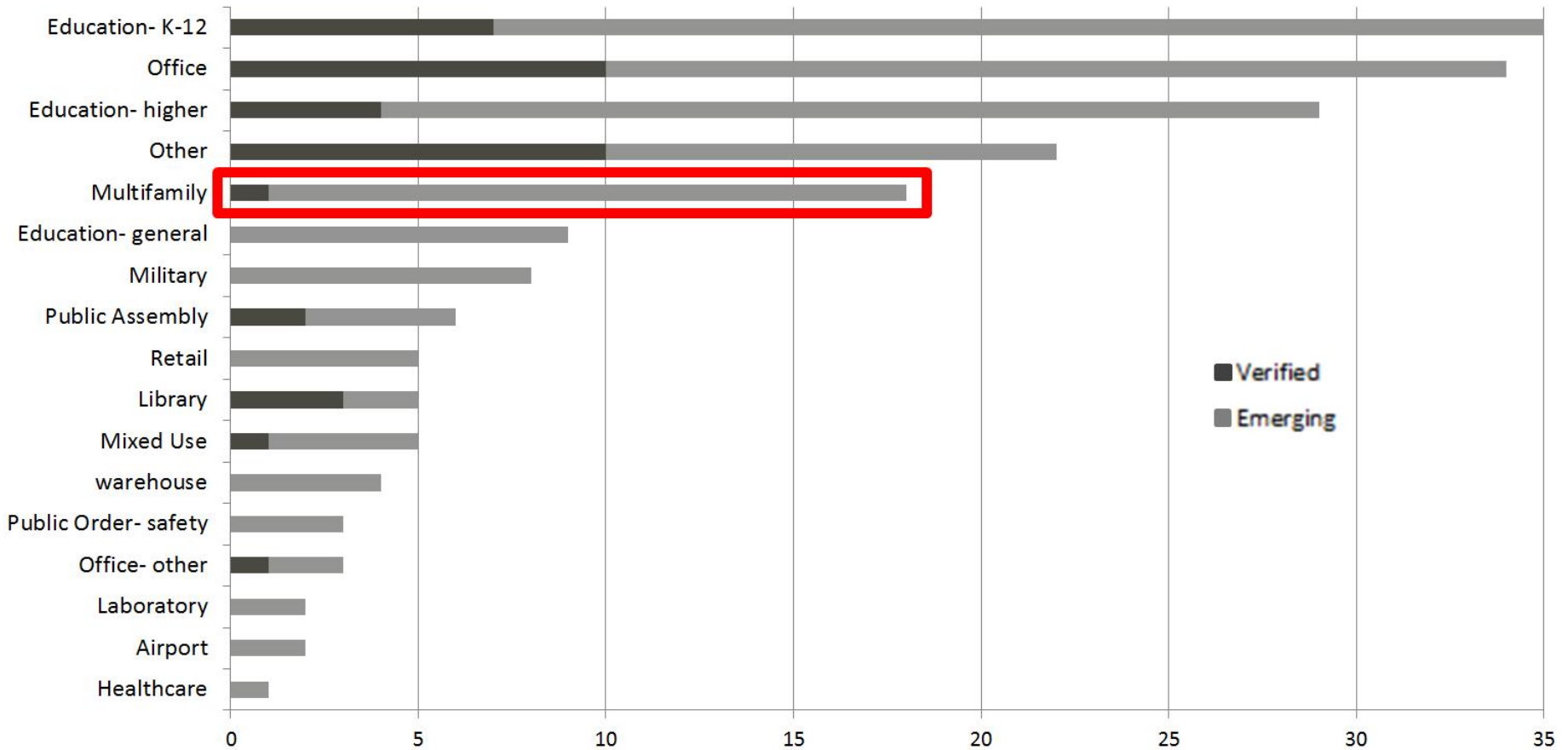
© New Buildings Institute, 2015

Zero Net Energy Buildings

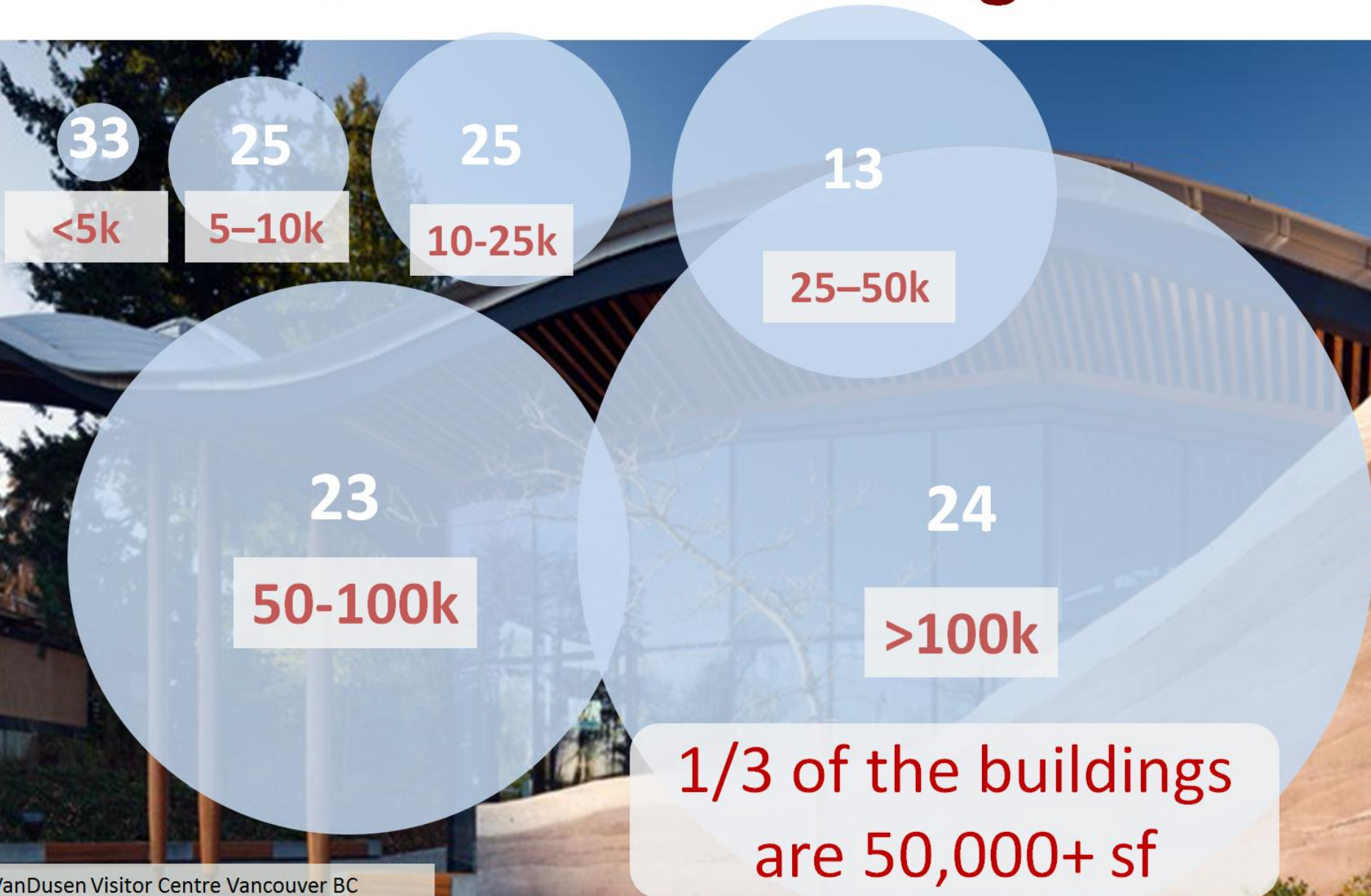


14 Building Types

ZNE Buildings by Type – NBI 2015 Interim Summary

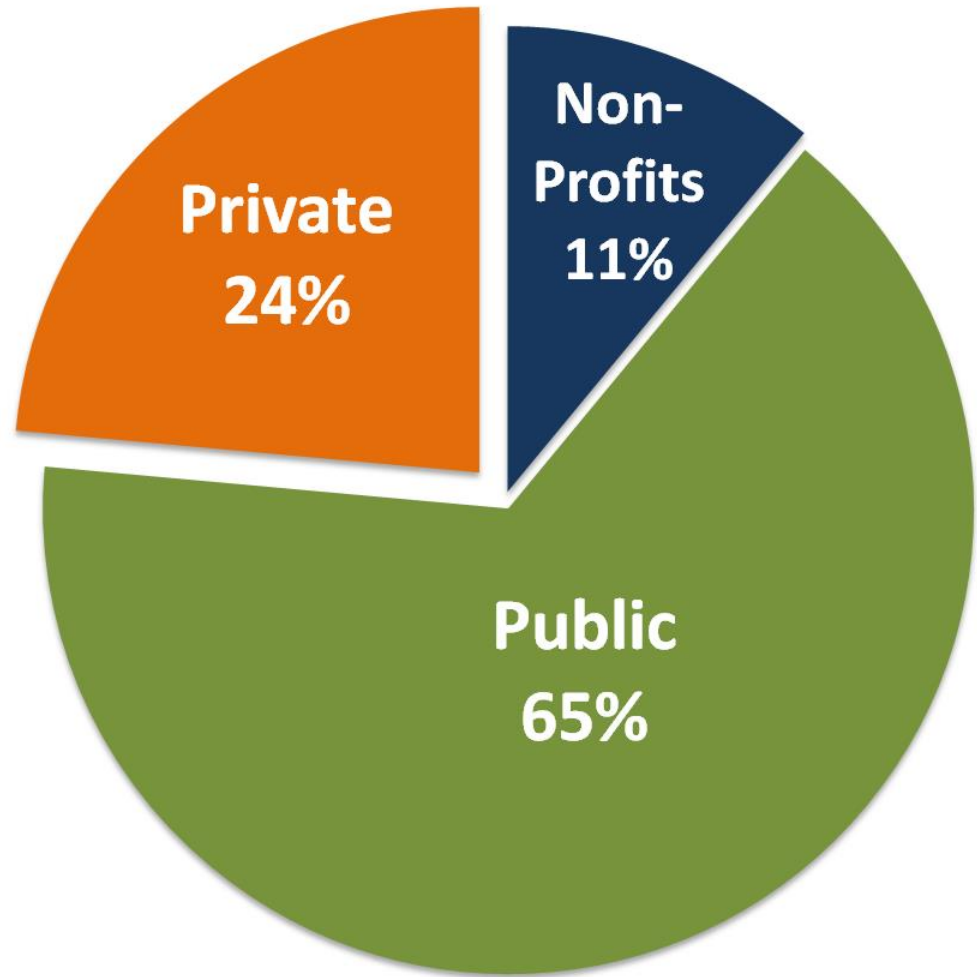


Size of ZNE Buildings



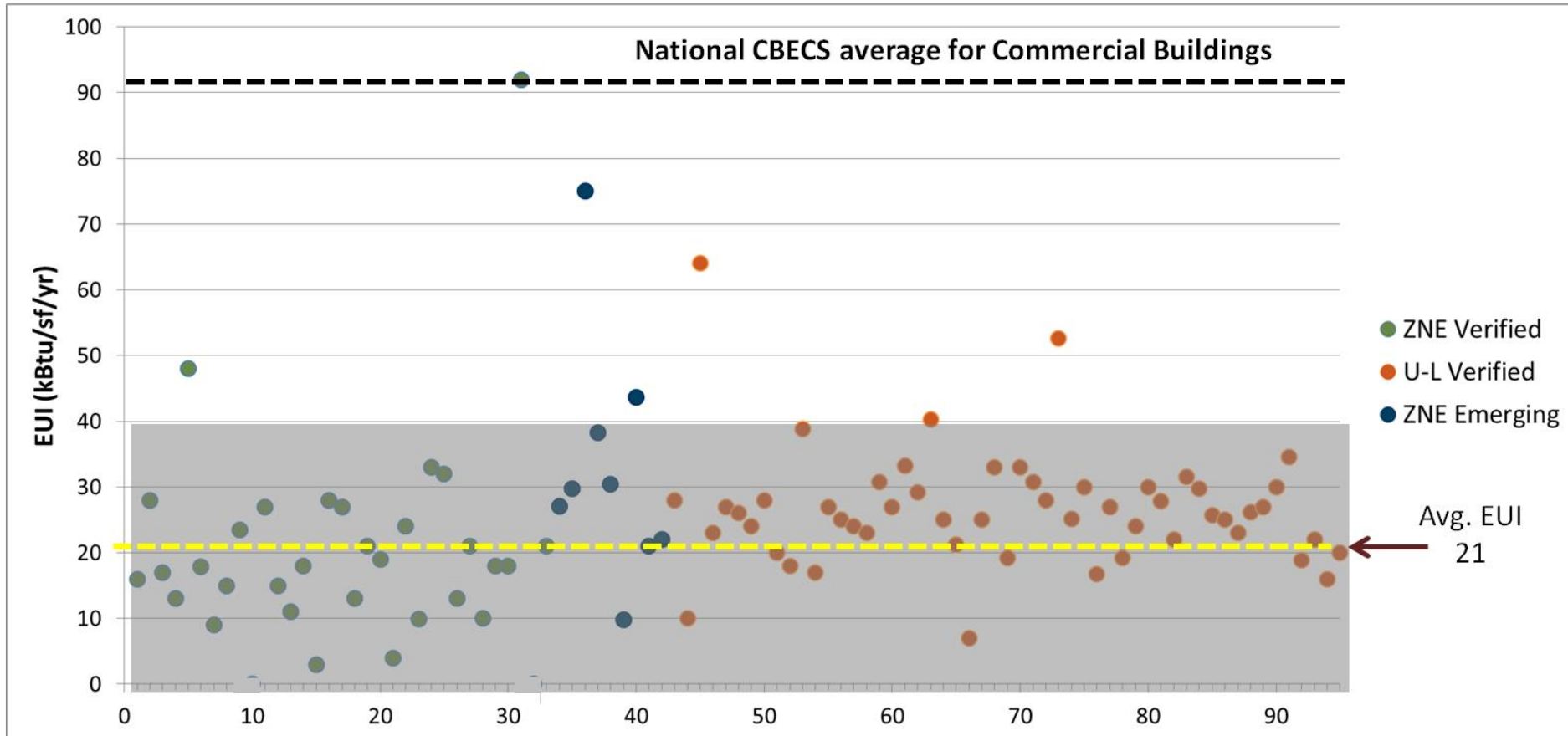


Owner Type



Performance Range

(measured performance data)



MULTIFAMILY PRECEDENTS



The Ramona, Portland, OR

Ultra-Low Energy Affordable Housing

6 Story, 138 Units, 230,762 SF, Certified LEED Gold, EUI of 18.7

The Ramona

Portland, OR

BENCHMARKS

LEED
LEED Gold
Architecture 2030

ENERGY

38% Saved
18.7 EUI

WATER

22% Saved
Low Flow Fixtures
Blackwater

FEATURES

PV
Solar Hot Water
Geothermal
Daylighting
Green Roof



MULTIFAMILY PRECEDENTS



- ① Solar Thermal & PV Panels produce electricity and hot water for building.
- ② Operable windows provide abundant daylighting & cross ventilation for cooling.
- ③ High efficiency boiler for hydronic radiant heaters.
- ④ More than 75 long- and short-term bicycle parking spaces are provided.
- ⑤ A community monitor tracks the building's progress to Net Zero Energy.

EcoFLATS, Portland, OR

Targeting Net Zero , 18-Unit Apartment Building

MULTIFAMILY PRECEDENTS



EcoFLATS, Portland, OR

Targeting Net Zero , 18-Unit Apartment Building

MULTIFAMILY PRECEDENTS



Z-Homes, Issaquah, WA

Net Zero Energy

10 -Unit, Attached Townhome Development

MULTIFAMILY PRECEDENTS



Bud Clark Commons, Portland, OR

Ultra-Low Energy Affordable Housing

108k SF. 130 studios + 90 bed men's transitional shelter, LEED Platinum



The Resource Access Center was designed to save \$51,000/year in energy and \$9,000/year in water.

(2010 rates)



At the RAC, \$60,000 will purchase:

- One year of **rent for 12 housing residents**, or
- One year of **dinner for 90 men** who live in the shelter, or
- One year of **salary for a case manager** to work with homeless clients in the day center

Multifamily, a unique opportunity



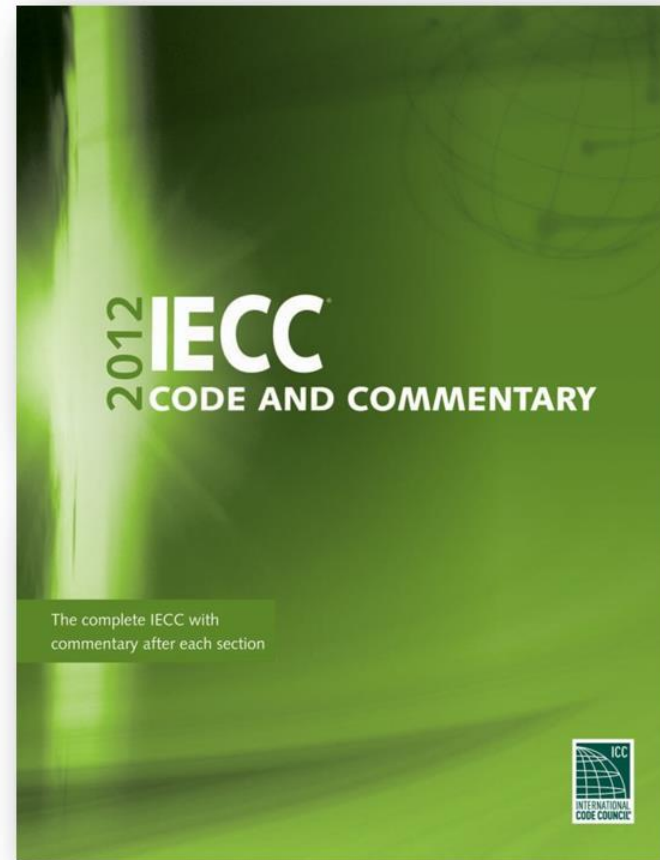
Multifamily, a unique opportunity



Multifamily, a unique opportunity



Multifamily, a unique opportunity



nbi new buildings
institute

redefining
what's possible
in the built
environment

A photograph of a modern building with a copper-clad facade and a wooden pergola structure. The building is surrounded by trees and has a stone wall in the foreground with the address "343 Second Street" inscribed on it. The sky is clear and blue.

Thank You!

ralph@newbuildings.org

343 Second Street

David and Lucille Packard Foundation Building
Courtesy: EHDD



ENERGY
SOLUTIONS

NEAR ZERO TO NET ZERO

27-April-2015 – Benjamin Knopp

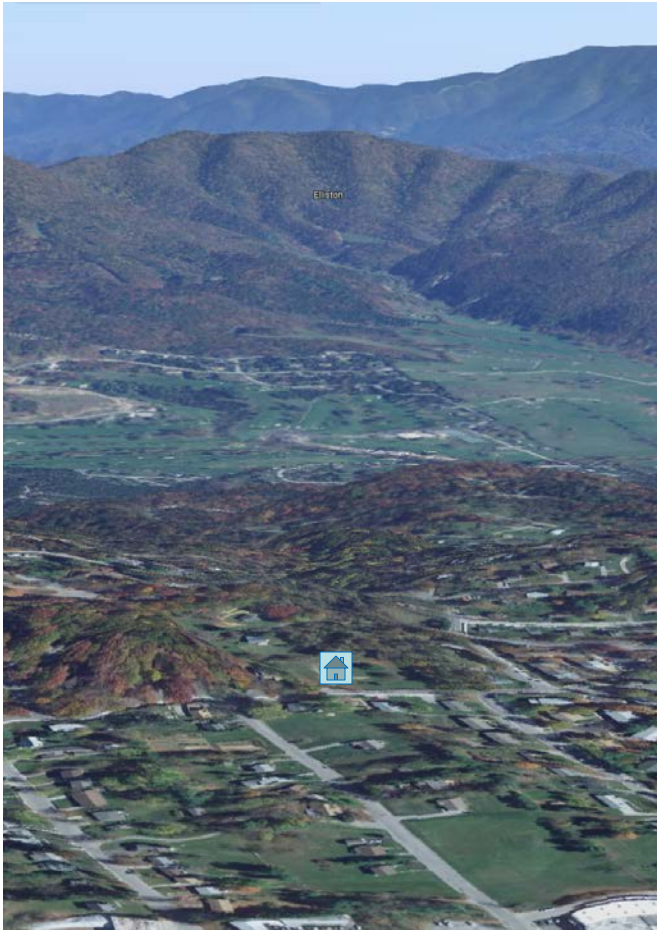


Grissom Lane: A Case Study

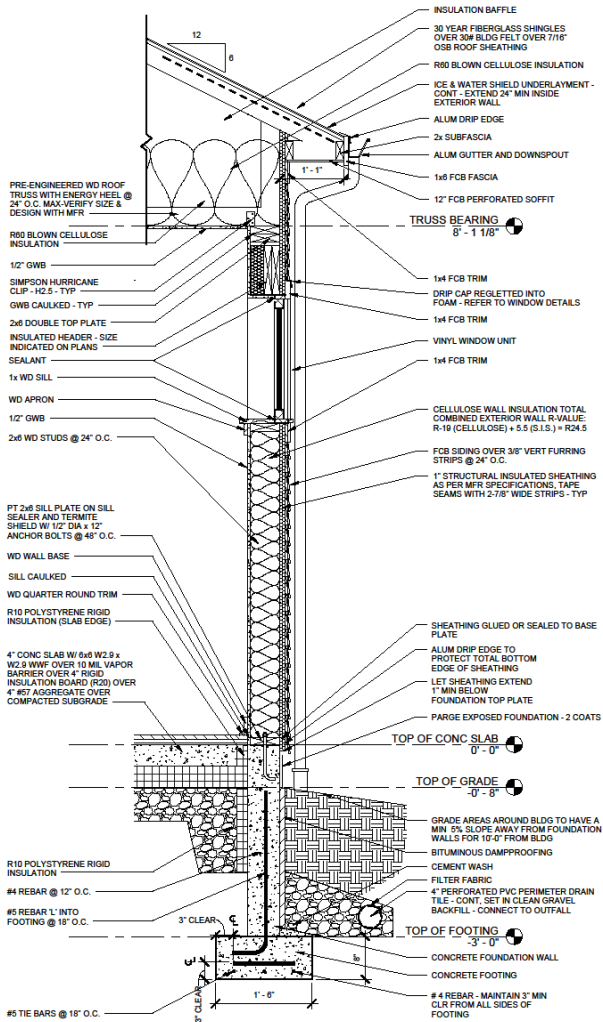


BACKGROUND

- ▲ Built in late 2014
- ▲ Blacksburg, Virginia
- ▲ Four duplexes
- ▲ Eight units (950ft²/ea)
- ▲ Senior affordable housing



ENVELOPE



▲ Floor: R-20 (EPS under slab)

▲ Walls: R-25 (cellulose + SIS)

▲ Ceiling: R-60 (cellulose)

▲ Windows: triple-pane

▲ Air Sealing: caulked sill,

taped sheathing, etc.

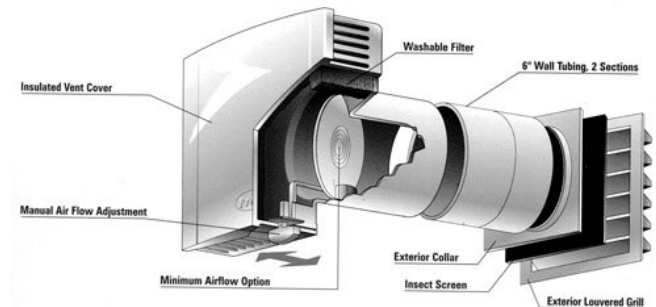
HVAC



▲ Mini-Split Heat Pump
21.5 SEER, 12.2 HSPF

▲ Distribution: slim interior ductwork

▲ Ventilation: exhaust-only with passive air inlets



WATER



- ▲ Fixtures: EPA WaterSense
- ▲ Layout: all $\frac{3}{4}$ " ($\frac{1}{2}$ " to tub)
- ▲ Water Heating: 2.75 EF
heat pump water heater



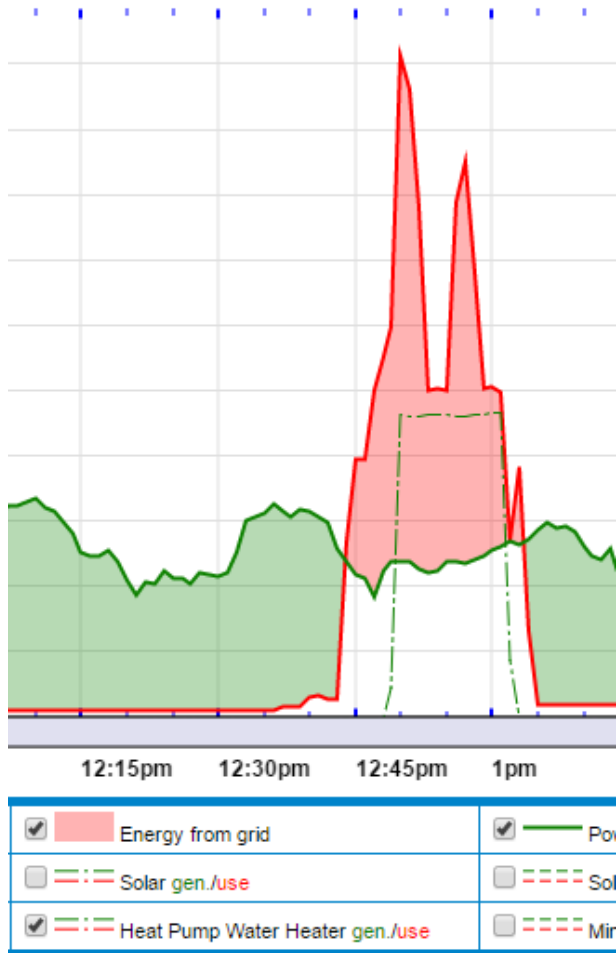
APPLIANCES

▲ Washer: ENERGY STAR

▲ Refrigerator: ENERGY STAR

▲ Lighting: 90% LED, 10% CFL

▲ Verification: circuit level energy monitoring



SOLAR

▲ 3.78 KW of PV per unit

▲ 34 KW of PV total



PERFORMANCE

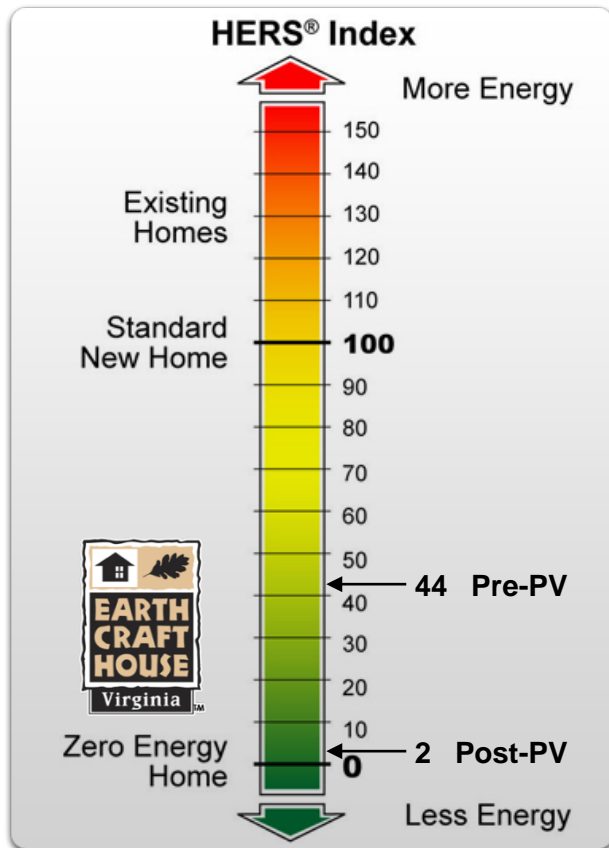
▲ CFM₅₀: 308

▲ ACH₅₀: 2.14

▲ CFM₅₀/SFBE: 0.1

▲ HERS 44 (pre-renewables)

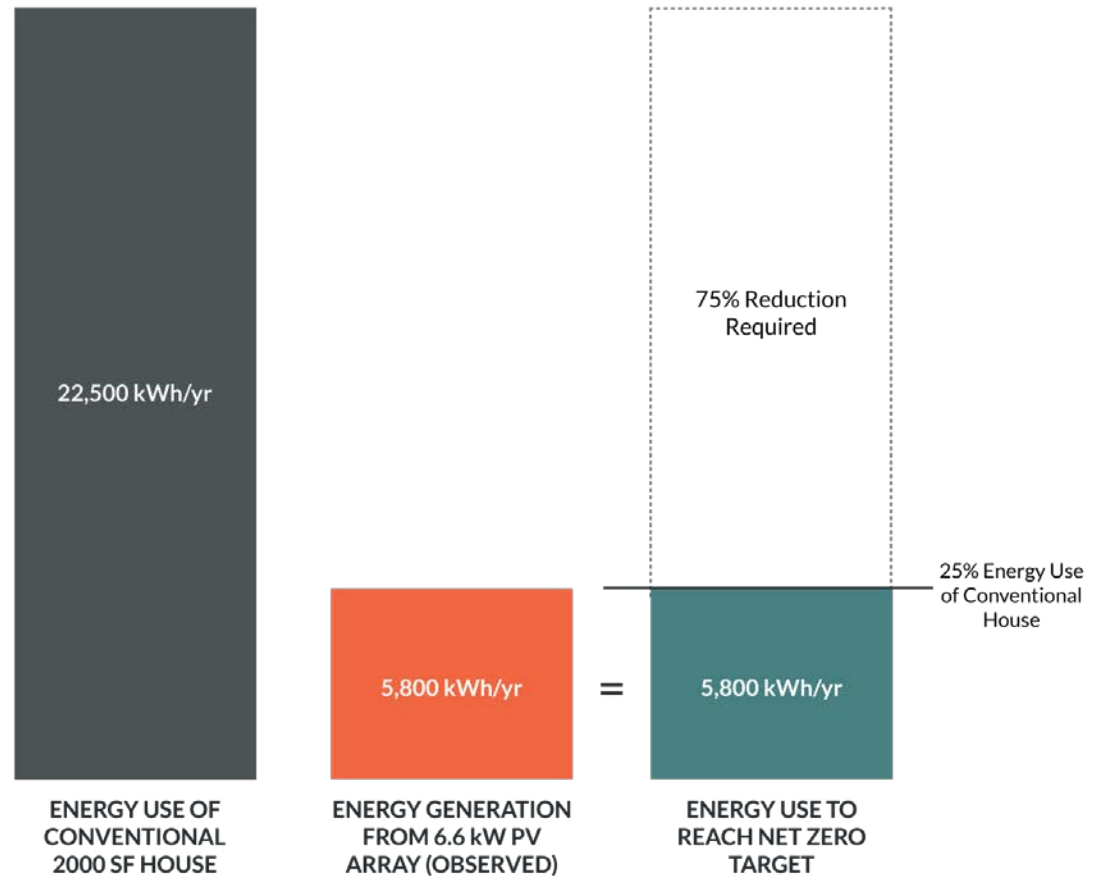
▲ HERS 2 (post-renewables)



A PATH TO NET ZERO

REACHING NET ZERO - PERFORMANCE IS KEY
75% REDUCTION IN ENERGY USE TO REACH NET ZERO

- ▲ Passive House Techniques
 - ▲ Orientation
 - ▲ Geometry
 - ▲ Super Insulation
 - ▲ Thermal Breaks
 - ▲ Airtight Enclosure
 - ▲ Windows & Doors
 - ▲ Mech. Equipment



Source: www.hammerandhand.com

NOTE: Net Zero calculations based on onsite generation from a 6.6kW PV array (typically the max practical size for SFHs in urban settings) for a 2000SF house. Based on conventional EUI of 38.4 kBtu/sf/yr (USEIA).

 Hammer & Hand
Redistribution okay with credit/link to hammerandhand.com
Typical Energy Distribution Data from Ecotope Inc. and NEEA

ENERGY BREAKDOWN

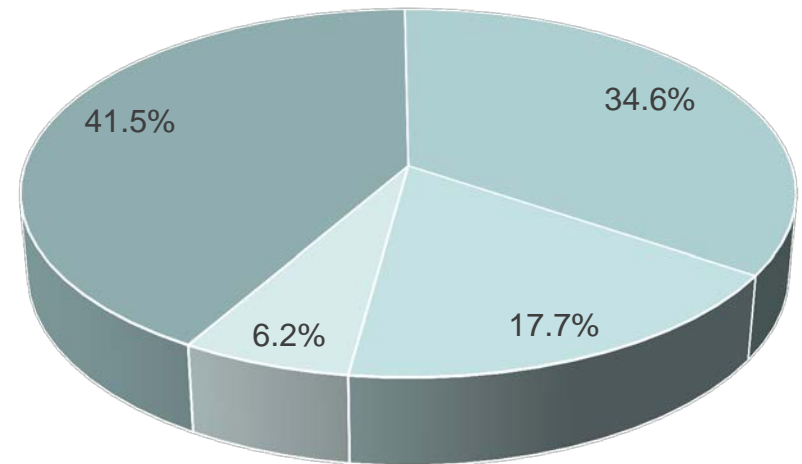
Energy End Use in US Homes

2009 Survey:

- ▲ Space heating/cooling: 48%
- ▲ Baseload: 52%

1993 Survey:

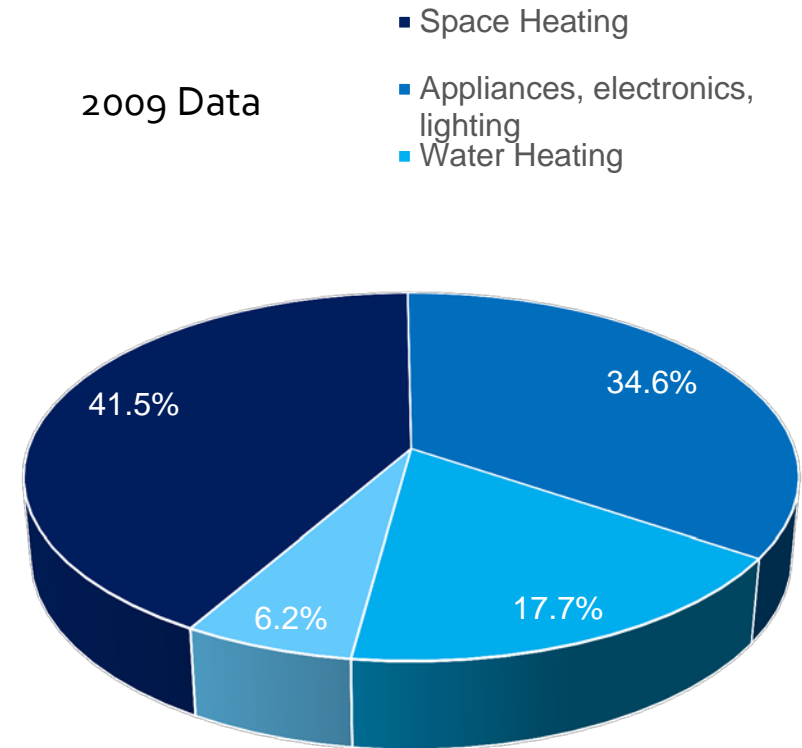
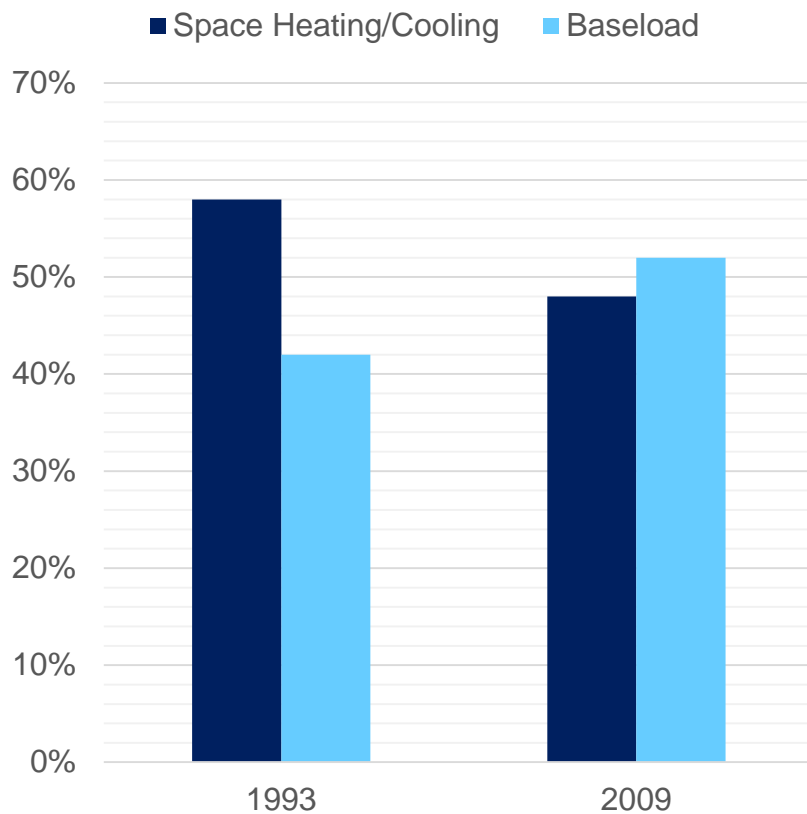
- ▲ Space heating/cooling: 58%
- ▲ Baseload: 42%



- Space Heating
- Appliances, electronics, lighting
- Water Heating
- Air Conditioning

ENERGY BREAKDOWN

Energy End Use in US Homes



Source: US Energy Information Administration

MULTIFAMILY ADVANTAGE

- ▶ Better volume-to-surface-area ratio
- ▶ Centralized systems
- ▶ Economies of scale
- ▶ Attract conscientious tenants



CONCLUSION

- ▲ Use proven techniques from high performance standards (Passive House, Living Building Challenge, etc.)
- ▲ Think “efficiency first, then renewables”
- ▲ Take advantage of economies of scale
- ▲ Include energy monitoring in project
- ▲ Include operations and maintenance plan
- ▲ Include tenant education – tenant behavior can make or break a net-zero project



QUESTIONS?

Presented by

Benjamin Knopp

Energy Specialist

Community Housing Partners

Energy Solutions

bknopp@chpc2.org



ENERGY
SOLUTIONS



Homes for Generations

Better Building Challenge – How to Get to NetZero in MultiFamily

Gina Ciganik, Vice President – Housing Development

Aeon's Vision:

that every person has a home and is interconnected within community.



Homes for Generations

Aeon and University of Minnesota Center for Sustainable Building Research –

New Const.

Subst. Rehab

Mod. Rehab

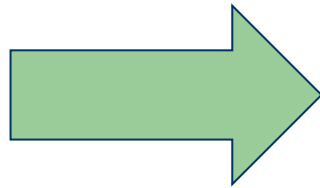
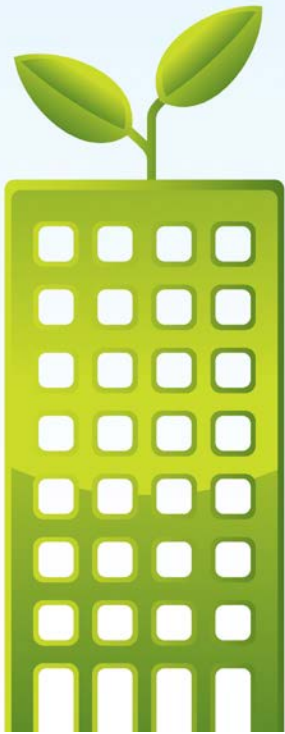


Utility Costs over 20 years...



**\$130
Million**

Replicable, Scale-able, Model...



Homes for Generations



What if every single act of design and construction made the world a better place?

- The Living Building Challenge™

LIVING BUILDING CHALLENGE™ 2.0

A VISIONARY PATH TO A RESTORATIVE FUTURE

www.ilbi.org



Homes for Generations



LIVING
BUILDING
CHALLENGE™

Seven Petals: The Living Building Challenge

MATERIALS

Red List
Embodied Carbon Footprint
Responsible Industry
Appropriate Sourcing
Conservation + Reuse

WATER

Net Zero Water
Ecological Water Flow

ENERGY

Net Zero Energy

HEALTH [and Happiness]

Civilized Environment
Healthy Air
Biophilia

SITE (Place)

Limits to Growth
Urban Agriculture
Habitat Exchange
Car Free Living

EQUITY

Human Scale + Humane Places
Democracy + Social Justice
Rights to Nature

BEAUTY

Beauty + Spirit
Inspiration + Education

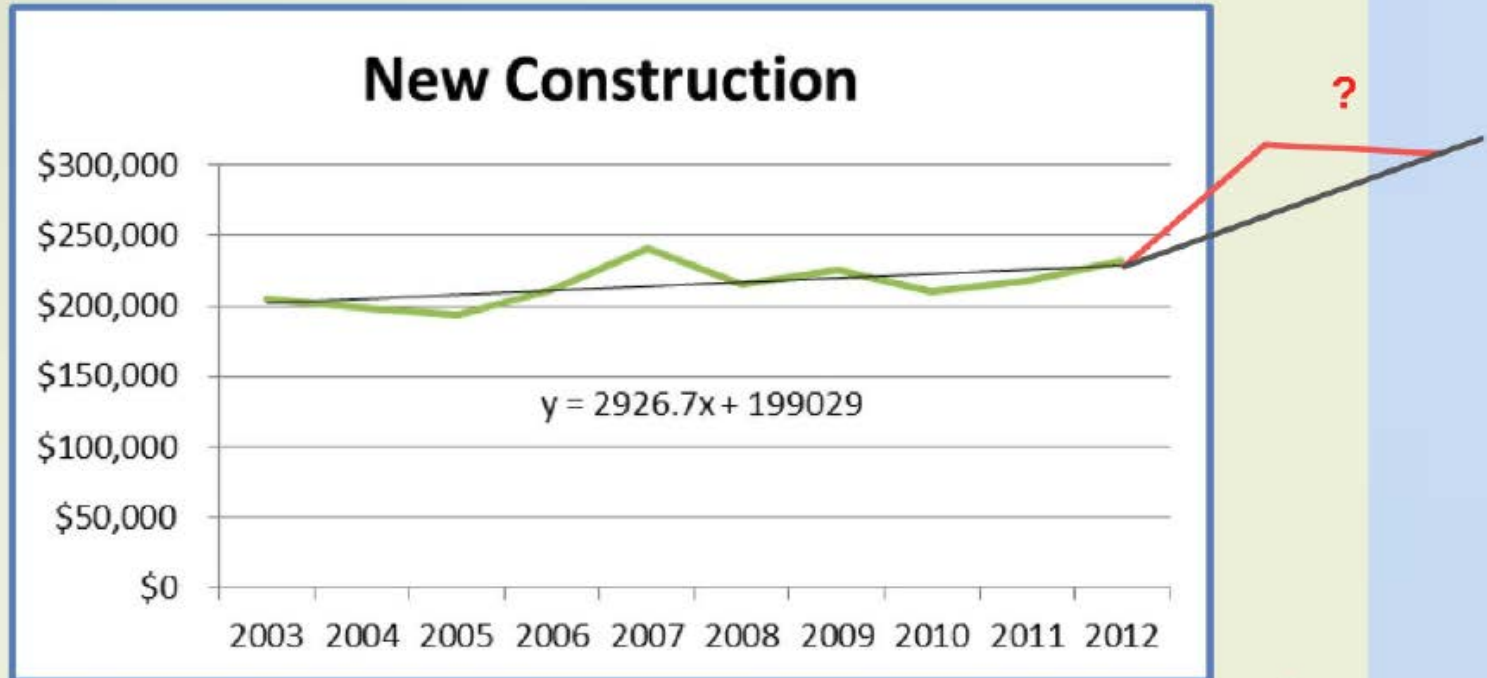


Homes for Generations

**Don't forget that
money is a scarce
resource too!!**



Minnesota's Cost Curve (adj. for inflation)





South Quarter = 240+ homes









AEON SOUTH QUARTER: THE ROSE
FINAL EXTERIOR RENDERINGS
01.24.2014

MSR

710 South 2nd Street, 8th Floor
Minneapolis, Minnesota 55401-2282

PORTLAND AVE. AND FRANKLIN AVE.
-PERSPECTIVE OF THE MAIN ENTRY FROM SOUTH EAST CORNER OF SITE



MSR
ARCHITECTS
MINNEAPOLIS, MN

DISCOVERY URBAN FARM BY HOPE COMMUNITY
AT THE ROSE, 1920-1928 PORTLAND AVE. MINNEAPOLIS, MN 55404

VIEW FROM NORTHWEST CORNER OF GARDEN



Homes for Generations

ENERGY



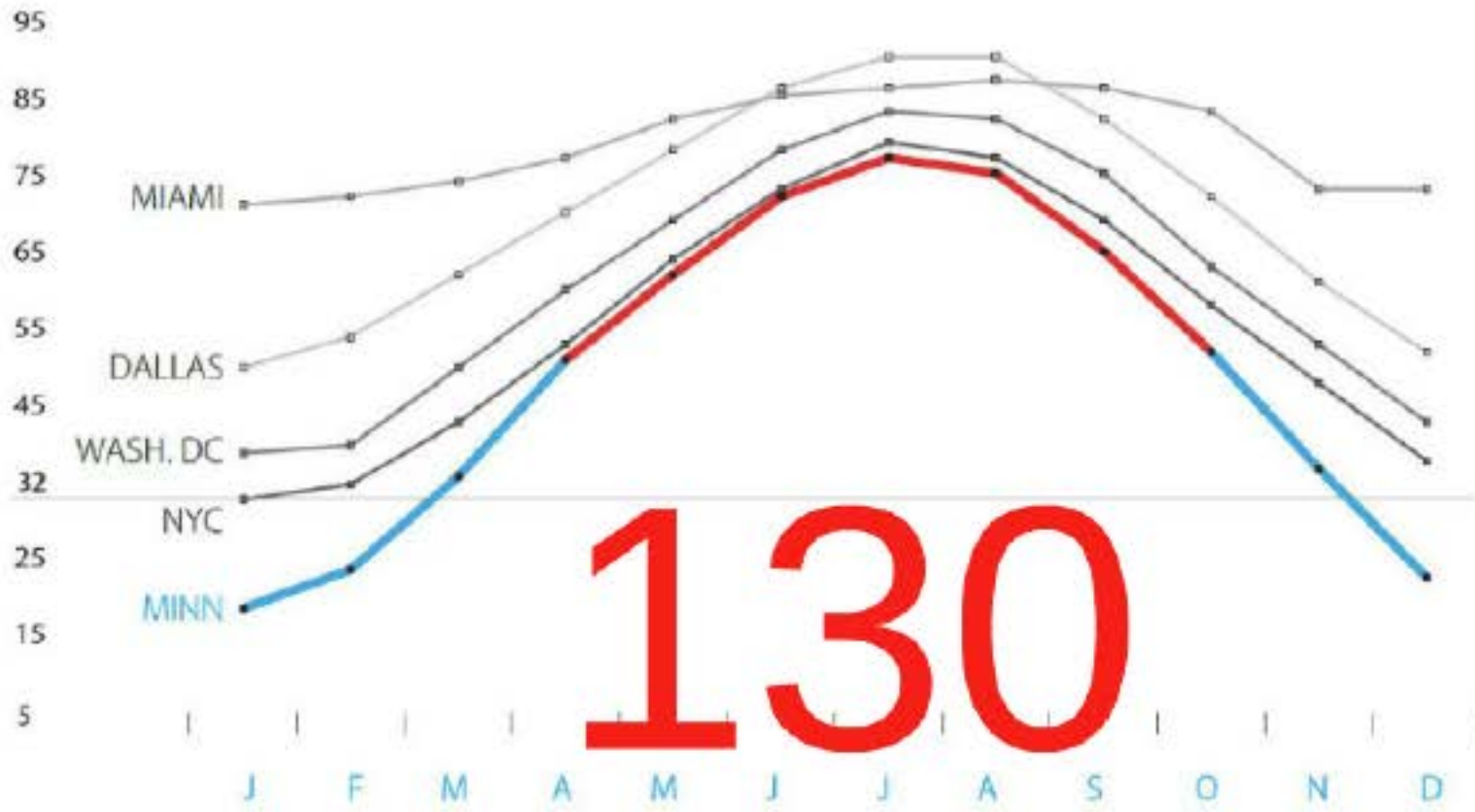


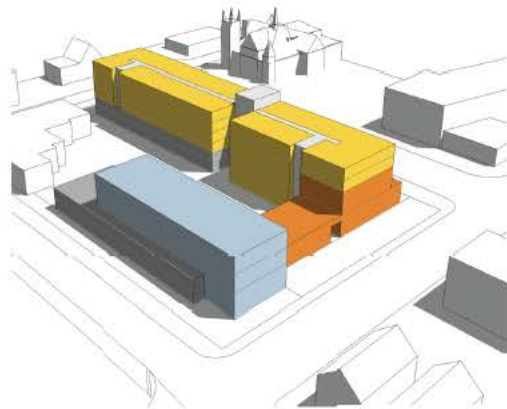
MSR
msrdesign.com


Homes for Generations


Homes for Generations

MONTHLY AVERAGE TEMPERATURE °F

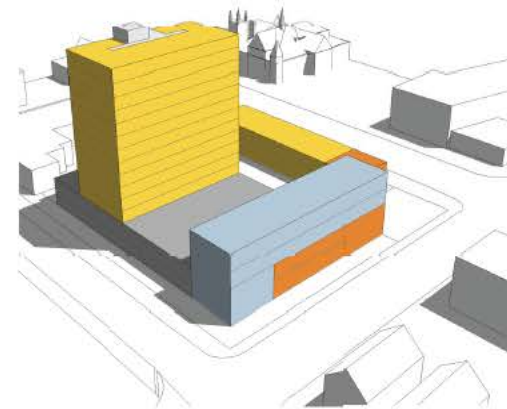




Scheme 01



Scheme 02



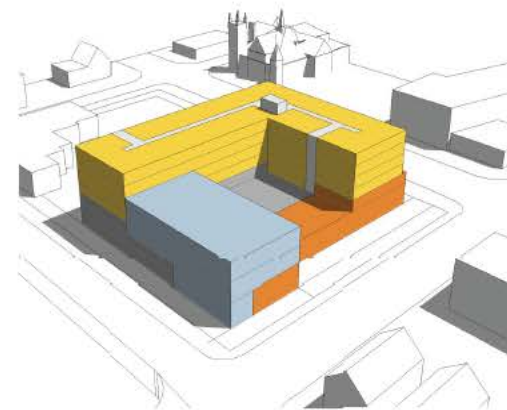
Scheme 03



Scheme 04



Scheme 05



Scheme 06



SOUTH QUARTER IV
Minneapolis, MN



Massing Options
May 2, 2011

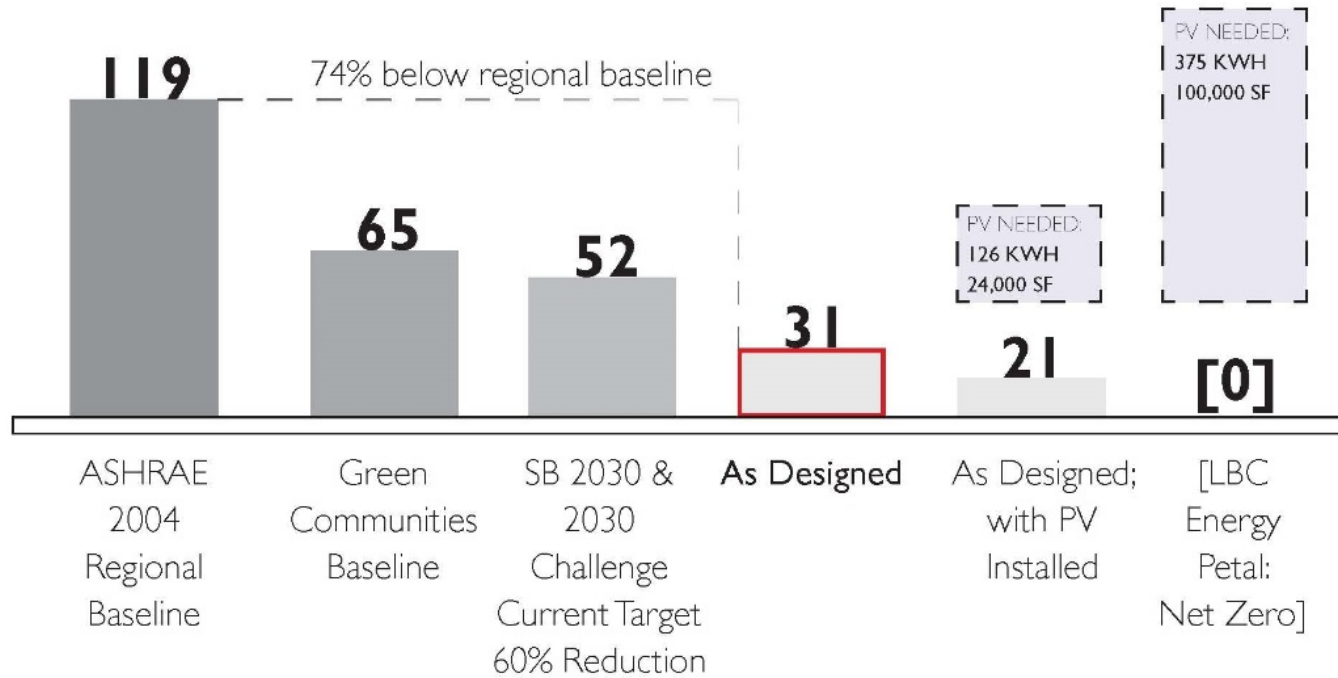


Orientation, Massing, Energy Modeling

ENERGY **Energy Use Intensity (EUI)**

What does this add up to?

Design EUI **31** kbtu / sf / year



Sustainable Living Resident Engagement Pilot Project



Balfour Beatty Communities

Achieving Net Zero with Balfour Beatty Communities



@TCInnovator

Tabitha Crawford, CEM, CDSM

SVP Balfour Beatty Investments

May 28th, 2015

Agenda

- ▣ About Our Company
- ▣ Why Net Zero Makes Business Sense
- ▣ Behavior: Beyond the Homes

Balfour Beatty Across the U.S.

- Over \$17.1 Billion Construction on LEED projects, not including NGBS, Energy Star, or residential portfolio
- New Homes Built Top 1% for Energy Efficiency (NAHB external review)
- 350 LEED APs
- Largest rooftop solar-powered community at Fort Bliss, TX 13.4 MW
- Built first / largest NGBS Emerald community (75% Net Zero)
- 2014 NGBS Multifamily Project of the Year – Fort Bliss Emerald Community

About Balfour Beatty Communities

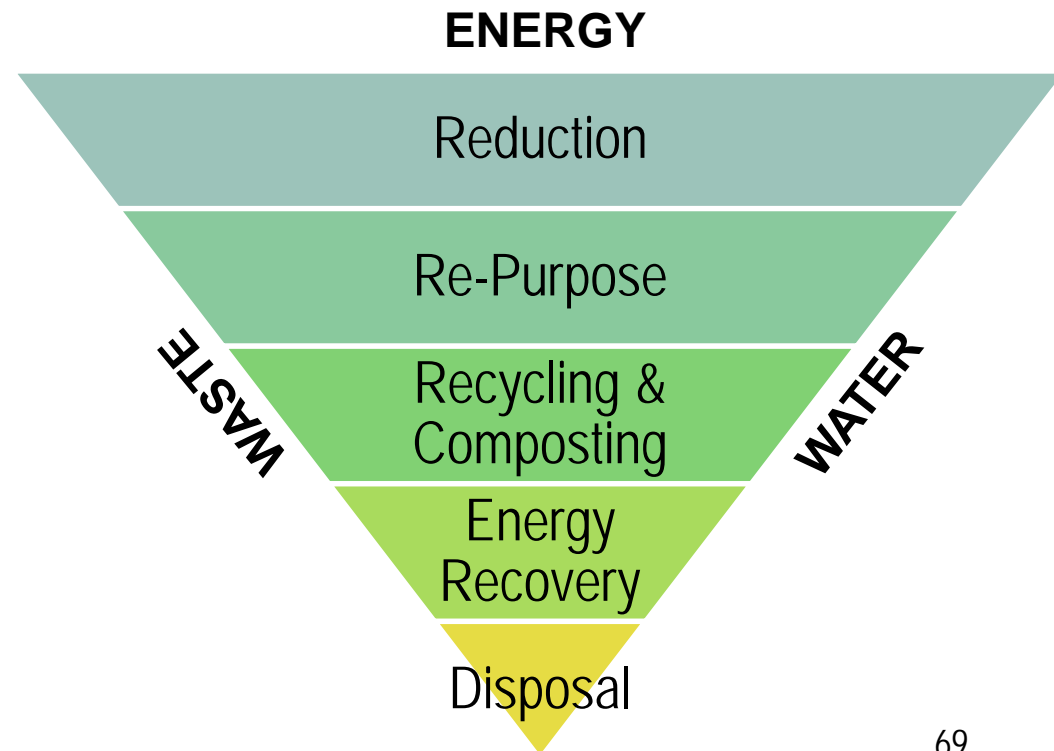
- Diverse Portfolio of Owned and Operated Properties
 - 45,000 Homes
 - 55 Military Housing
 - 8 Student Accommodation
- North American PPP Focus
 - Military Family Housing
 - Municipal Centers
 - Hospitals

Net Zero in our DNA

- Net Zero Higher Education:
 - Portland Community College, Sylvania Campus, OR
 - University of Hertfordshire, UK
- Texas' first Net Zero Public Middle School
- Net Zero Gov't Bldg Edith Green-Wendell Wyatt Fed Reserve
- First Zero Carbon Office in Hong Kong
- Army Partner for Housing at:
 - 2 "Net Zero Installations"
(Waste, Water, Energy: Fort Carson, Fort Bliss)
 - 2 "Net Zero Energy" Installations (West Point, Fort Detrick)

Why Net Zero—The Business Case

- ❑ Reduced Operating Costs
- ❑ Increased Energy Security
- ❑ Enhanced Community Sustainability
- ❑ Client Driven Standard



Fort Bliss NGBS Emerald Community: Near Net Zero

- 250 New Multi-family Development
- Largest Emerald Certified Community
- Only a 3% Construction Cost Premium
- 13.4 MW

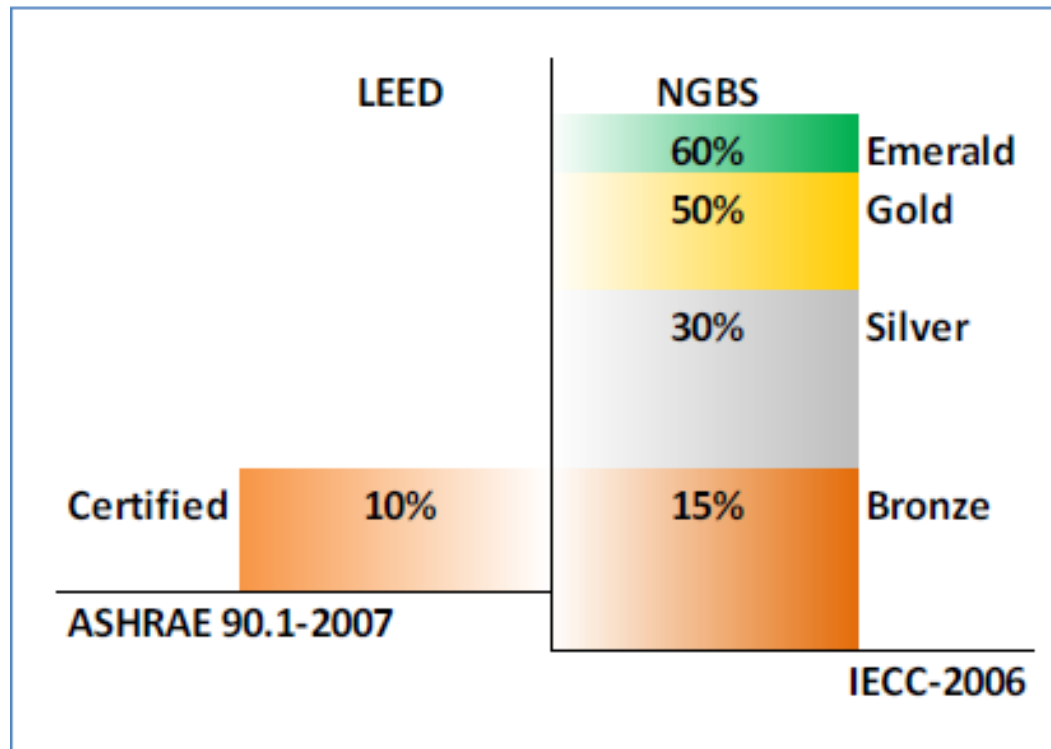
Community Solar



Why NGBS? Reduced Operating Expenses

- ❑ Utilities = Major Expense for Housing Portfolio
- ❑ Every Dollar Saved = Improved Amenities Quality of Life for Residents

**Table 1 – Minimum Energy Efficiency Requirements
Percentage Improvement Above Code**





5,200+ kWh savings/year per home
1,300,000 kWh savings/year all homes



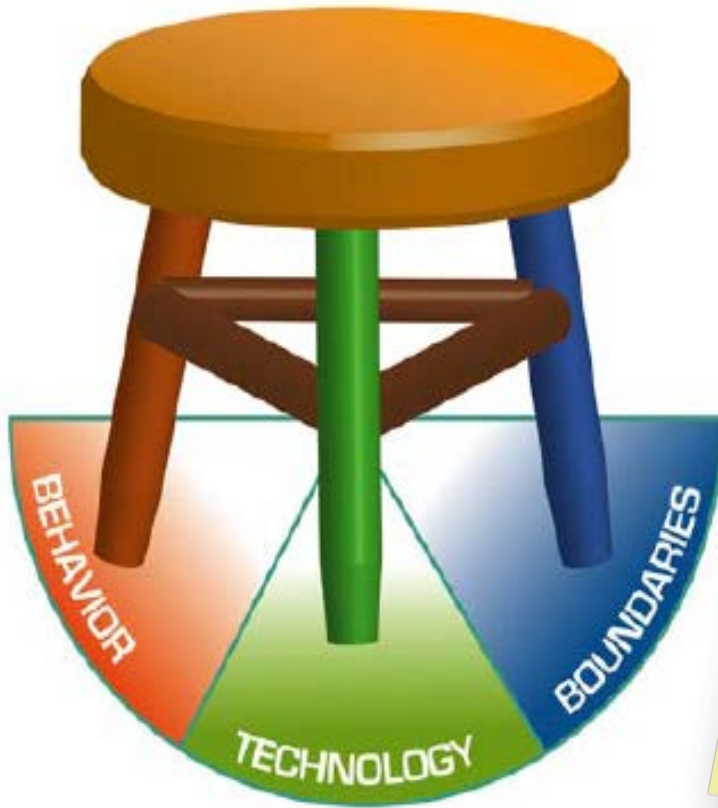
\$383/year per home*
\$95,000/year all homes*

*Based on 2012 electric rate of \$0.073/kWh

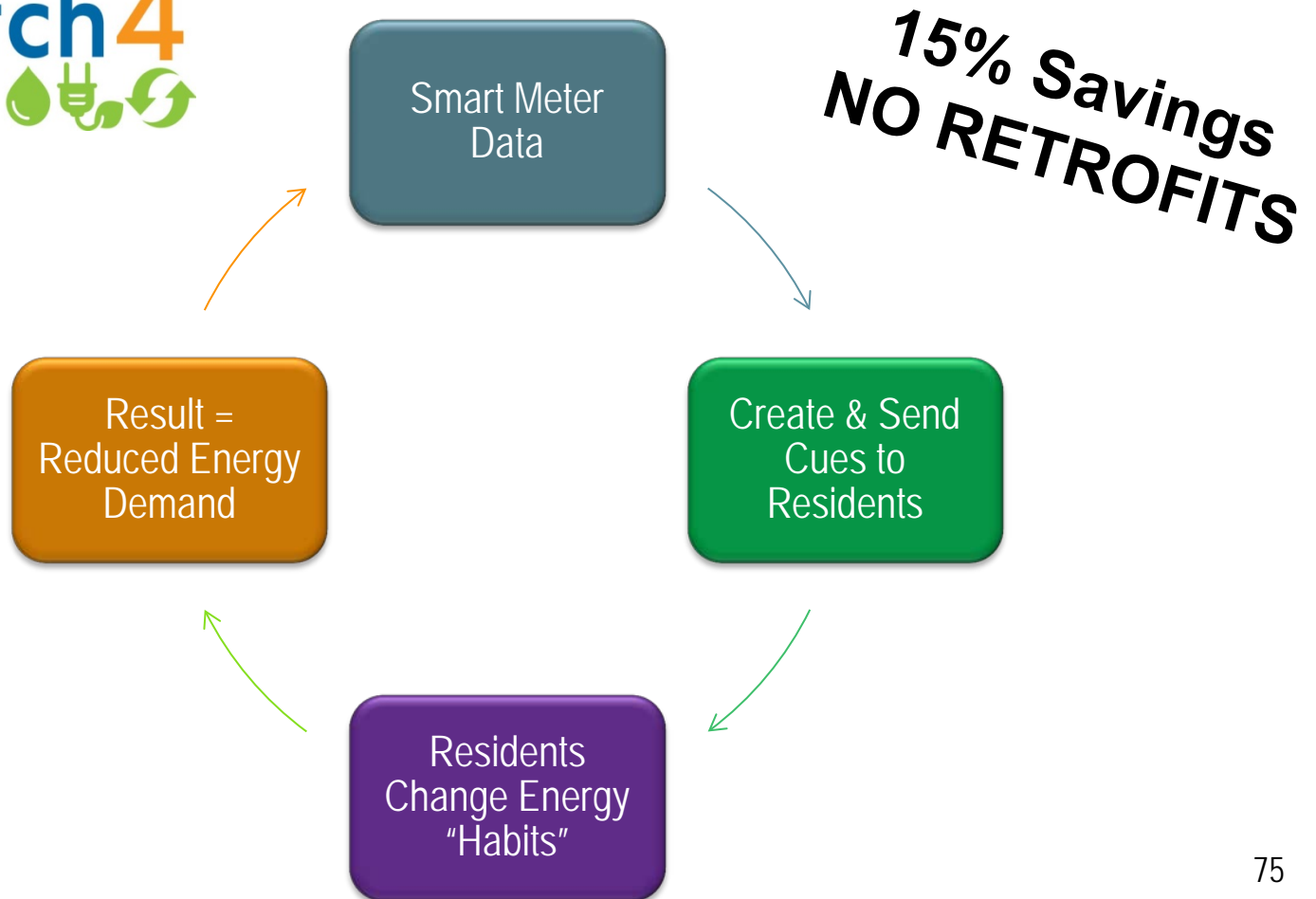
3rd Party Owned Rooftop Creates No Cost to Project



Behavior, Big Data & Smart Meters

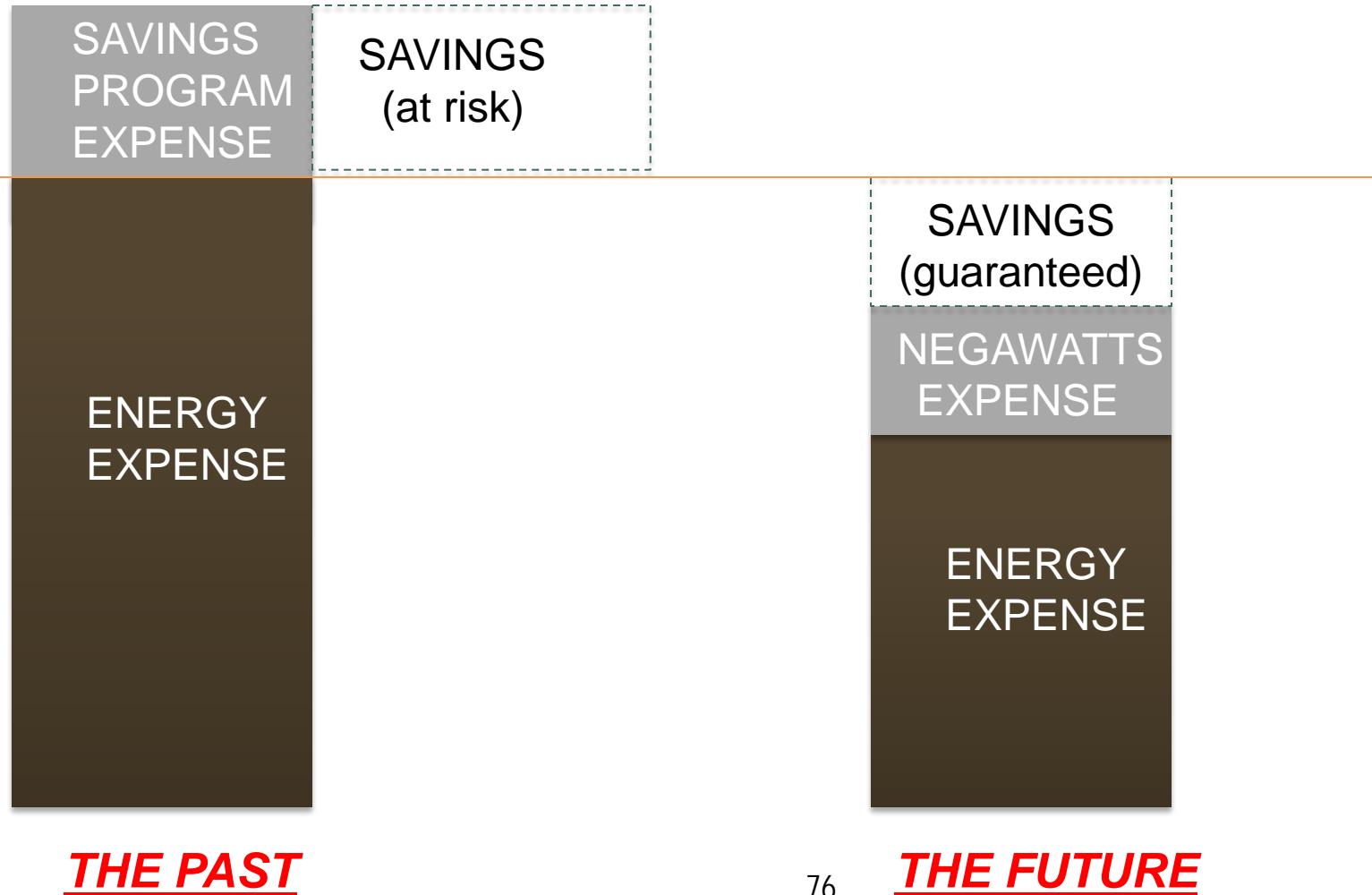


Demand Side Management



- Eliminate Upfront Cost – 3rd Party ESPC / PPA Type Model
- Guarantee No “Out of Pocket” Risk for Owner or Residents

Guaranteed Negawatts: Changes the conversation



For more information....

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