Getting to Zero Net Energy Buildings

Practices, Policies and People

Cathy Higgins
Research Director
New Buildings Institute

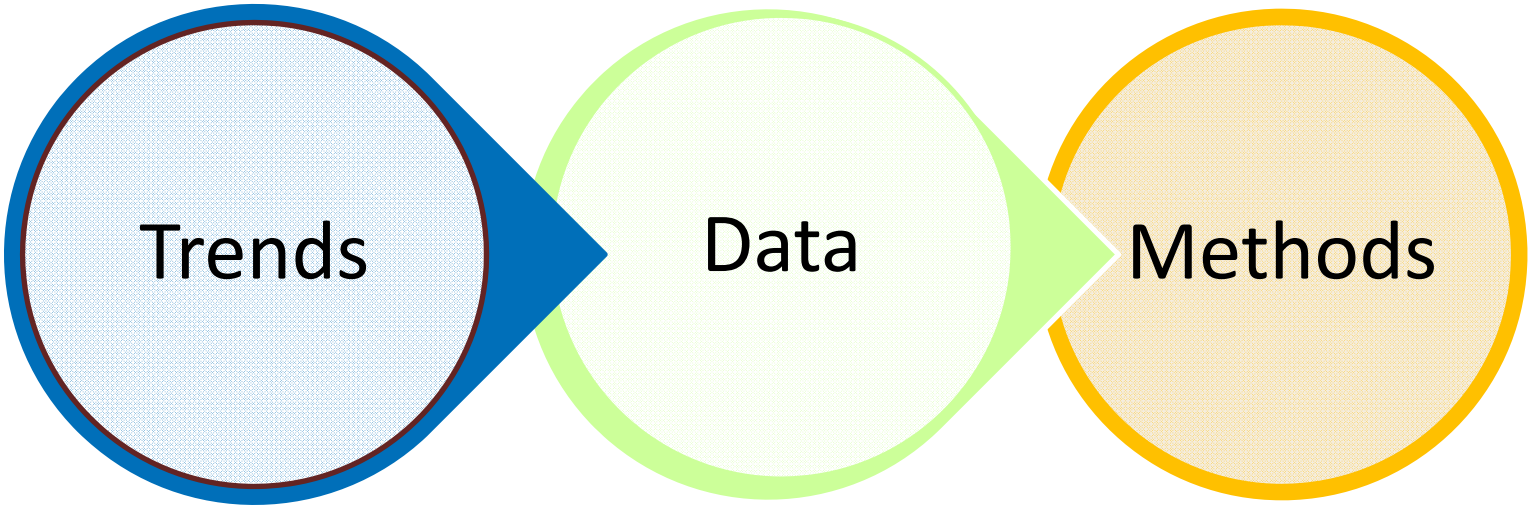
ASHRAE Golden Gate Chapter

October 19, 2016

nbi new buildings institute

We are an engine of innovation for the energy efficiency industry. We drive research, uncover solutions, and advance industry practices and policies that deliver positive change in the built environment.

Today's Topics



Trends – Policies & Market

Photo: Sherman Carter Barnhart

US General Services Administration

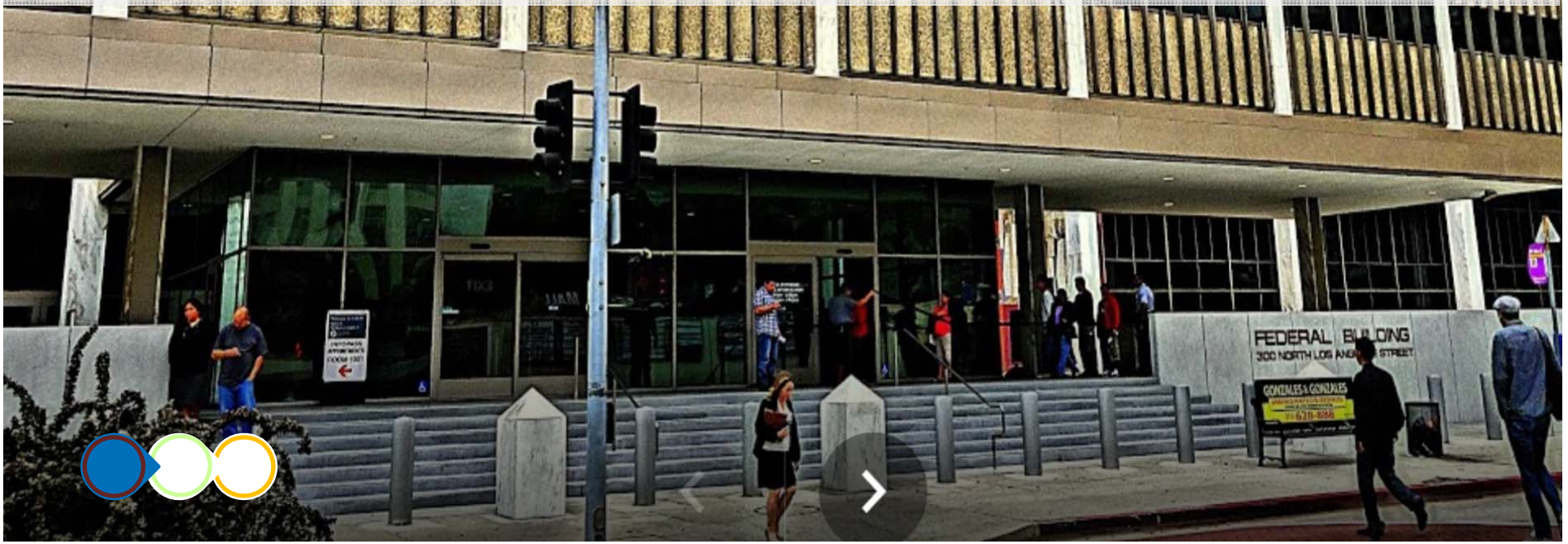
Jay E. Jenkins

NOV 2013

Los Angeles, CA

Federal Movement to Zero:

By 2030 each GSA regional operating division should verify at least ***50% of their building area to be NZE,*** *and should continue planning additional NZE projects.*



Benchmarking & Disclosure

Building Rating

IMT INSTITUTE FOR MARKET TRANSFORMATION

Regional Movements

Pacific Coast Action Plan *on* Climate and Energy

Preamble

The Governments of California, British Columbia, Oregon and Washington,

Pursuant to the *Memorandum to Establish the Pacific Coast Collaborative* of June 2008, as provided for in Article 6;

existing carbon-pricing programs. Where possible, California, British Columbia, Oregon and Washington will link programs for consistency and predictability and to expand opportunities to grow the region's low-carbon economy.

2) **Harmonize 2050 targets for greenhouse gas reductions and develop mid-term targets needed to support long-term reduction goals.**

CA Movement to Zero

Exploratorium | San Francisco, CA

CA "Big Bold" Goals

1. All new commercial construction will be ZNE by 2030

2. 50% of existing buildings will be retrofit to ZNE by 2030

3. All new residential construction in California will be ZNE by 2020

The California Efficiency Strategic Plan (Sep 2008)
californiaenergyefficiency.com/docs/
EEStrategicPlan.pdf

Leading by Example

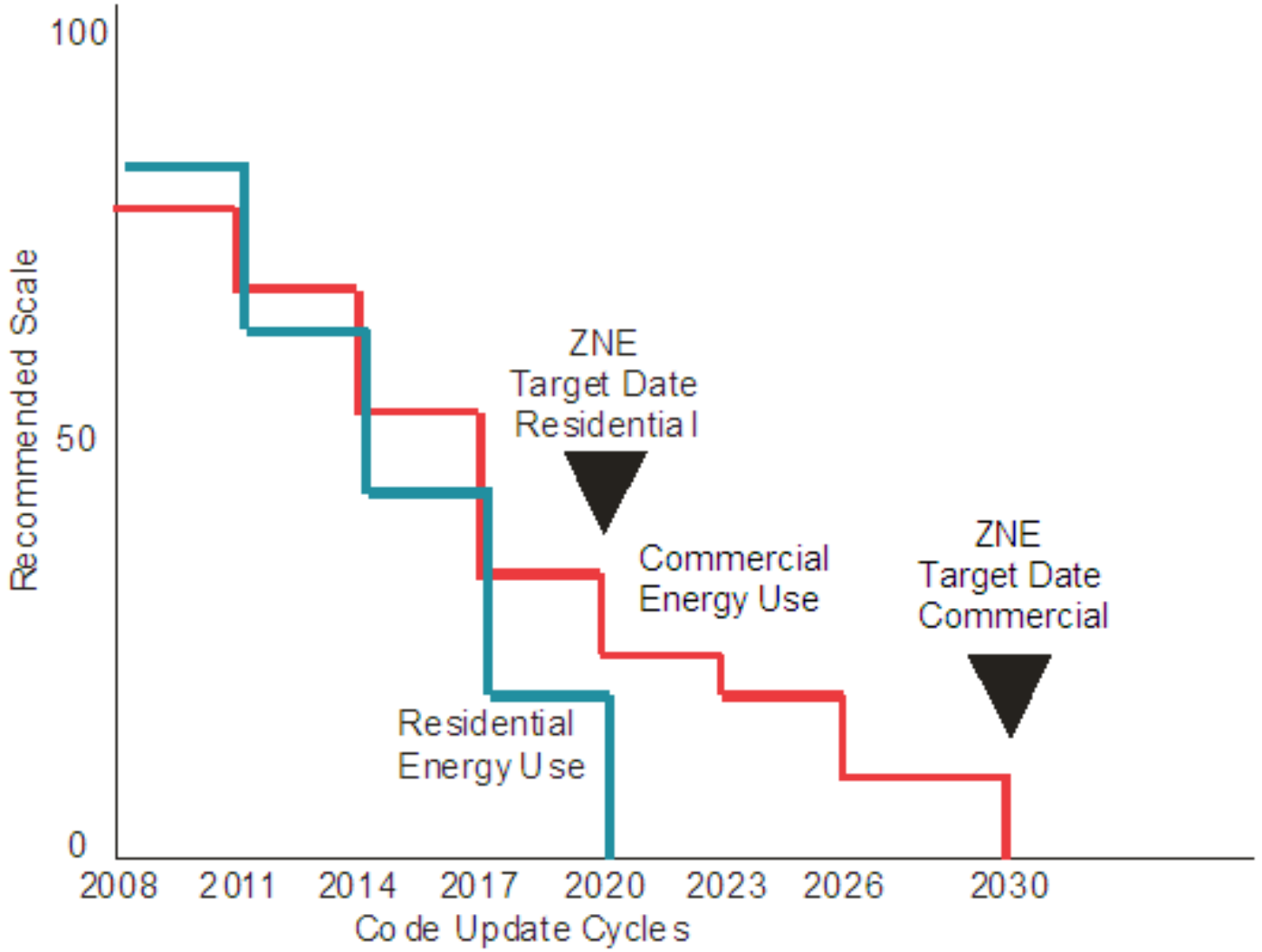
California's Policy for Public Buildings

Executive Order B-18-12: state buildings to significantly reduce energy by 2030.

- New or major renovation of State buildings larger than 10,000 square feet use clean, and clean back-up power supplies

- 50% of new facilities beginning design after 2020 to be Zero Net Energy.
- 100% of new State buildings & major renovations beginning design after 2025 to be ZNE

Code Cycles to Net Zero in CA



Code Cycles to ZNE, Source: SCE & AEC

Data on ZNE Building

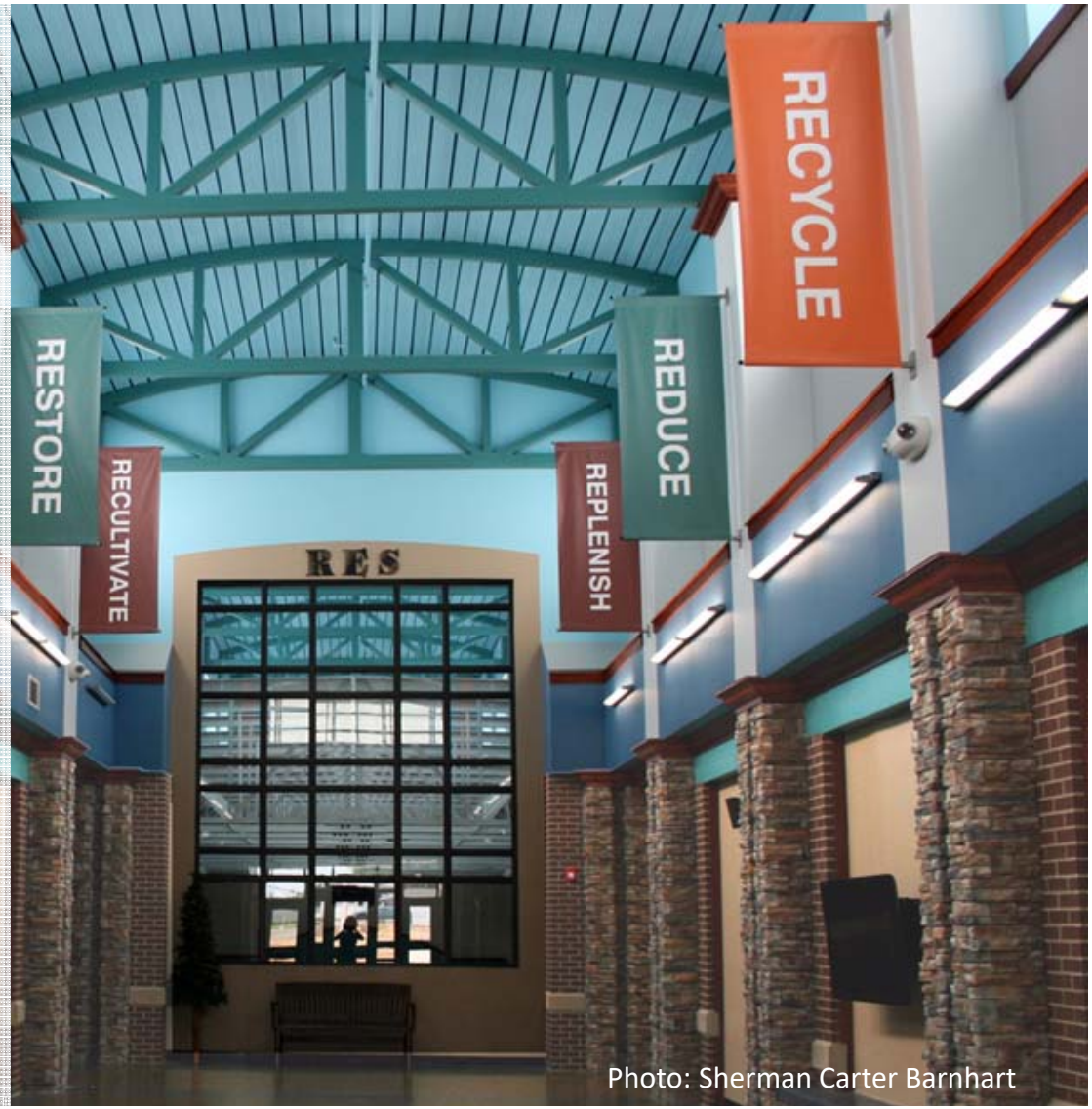
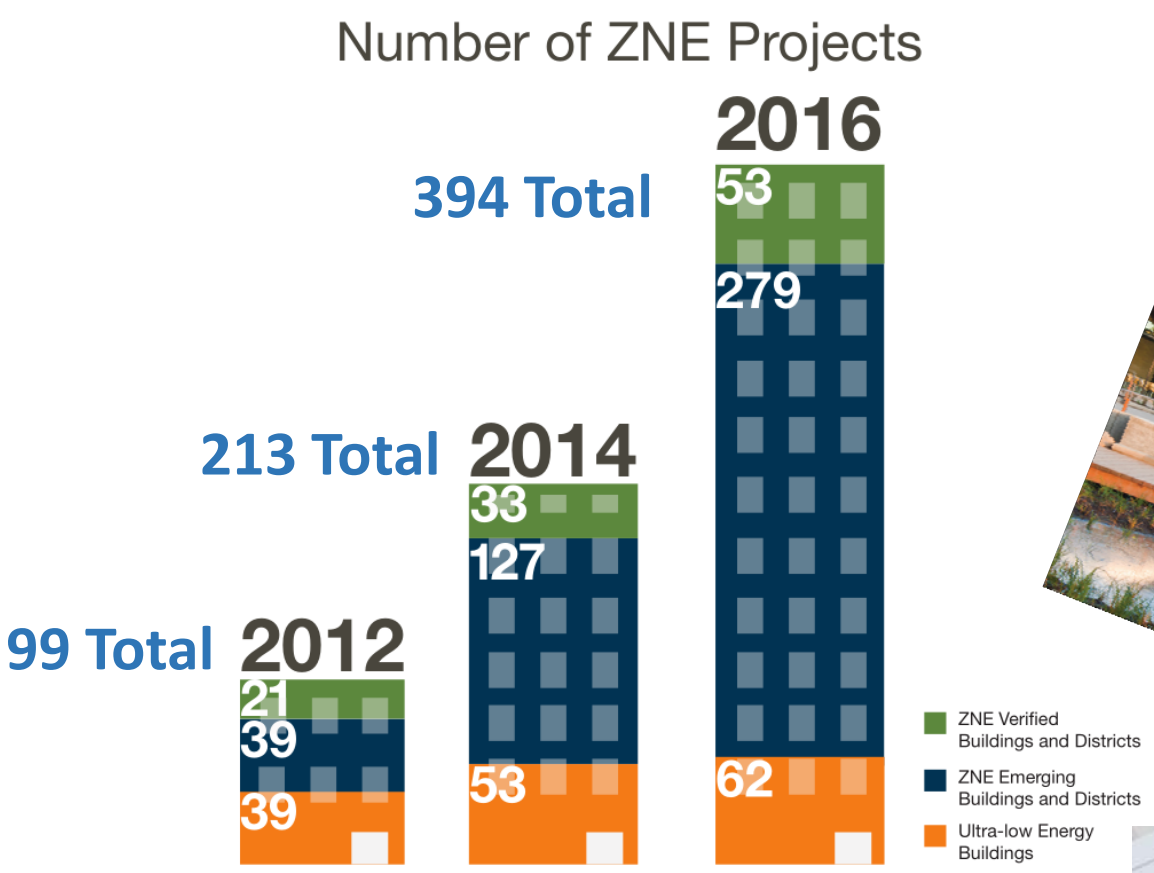
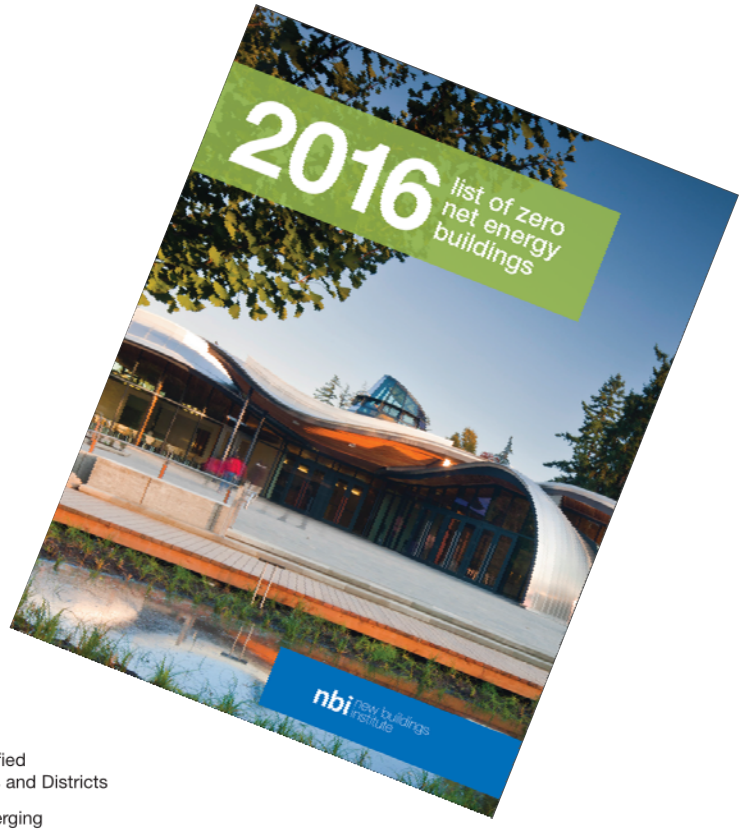


Photo: Sherman Carter Barnhart

NBI's 2016 List of ZNE Buildings!





The Name Game

- Zero Energy Buildings

Zero Net Energy

Zero Carbon Buildings

Net Zero Energy

Zero Electric Buildings

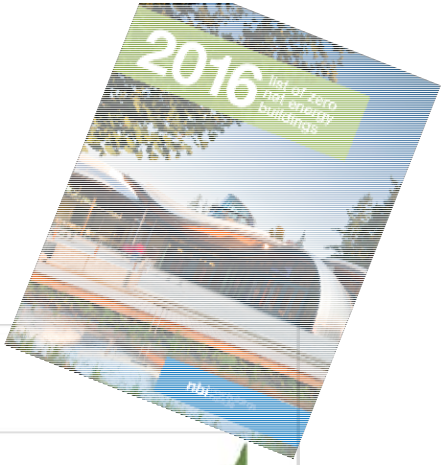
Living Buildings

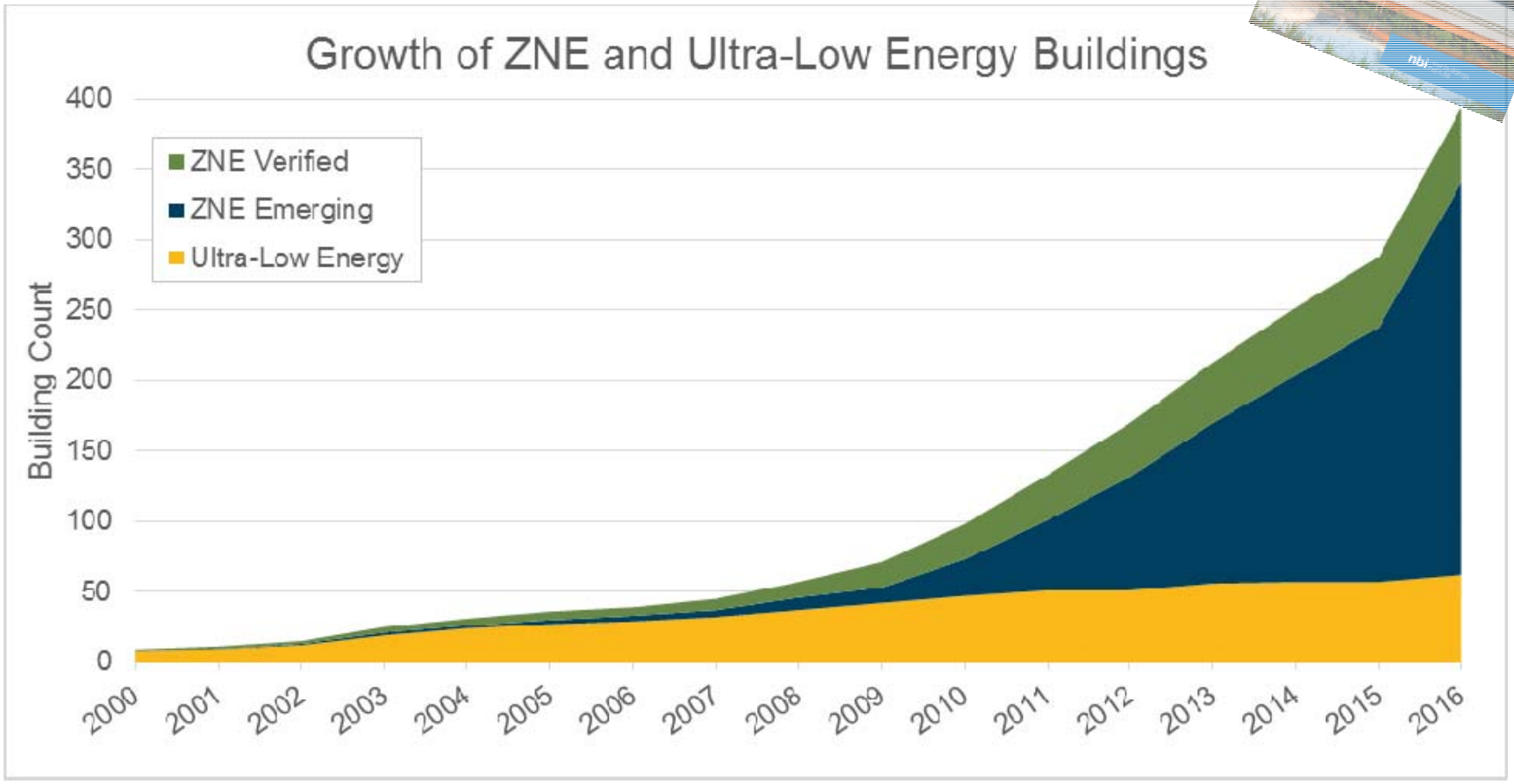
Nearly Zero Energy Buildings

Zero Net Ready Buildings

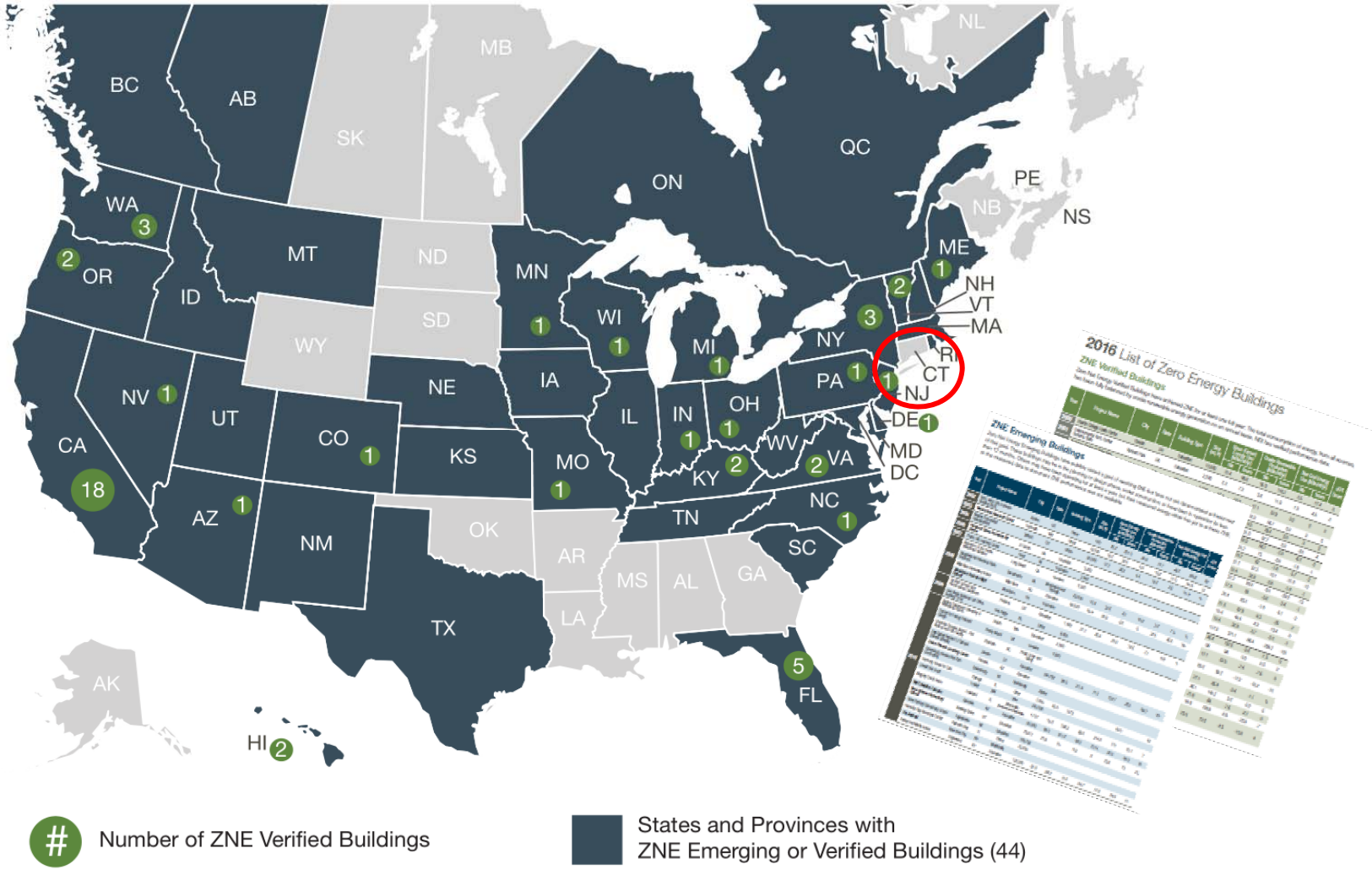
Ultra-low Energy Buildings

Growth in ZNE Buildings





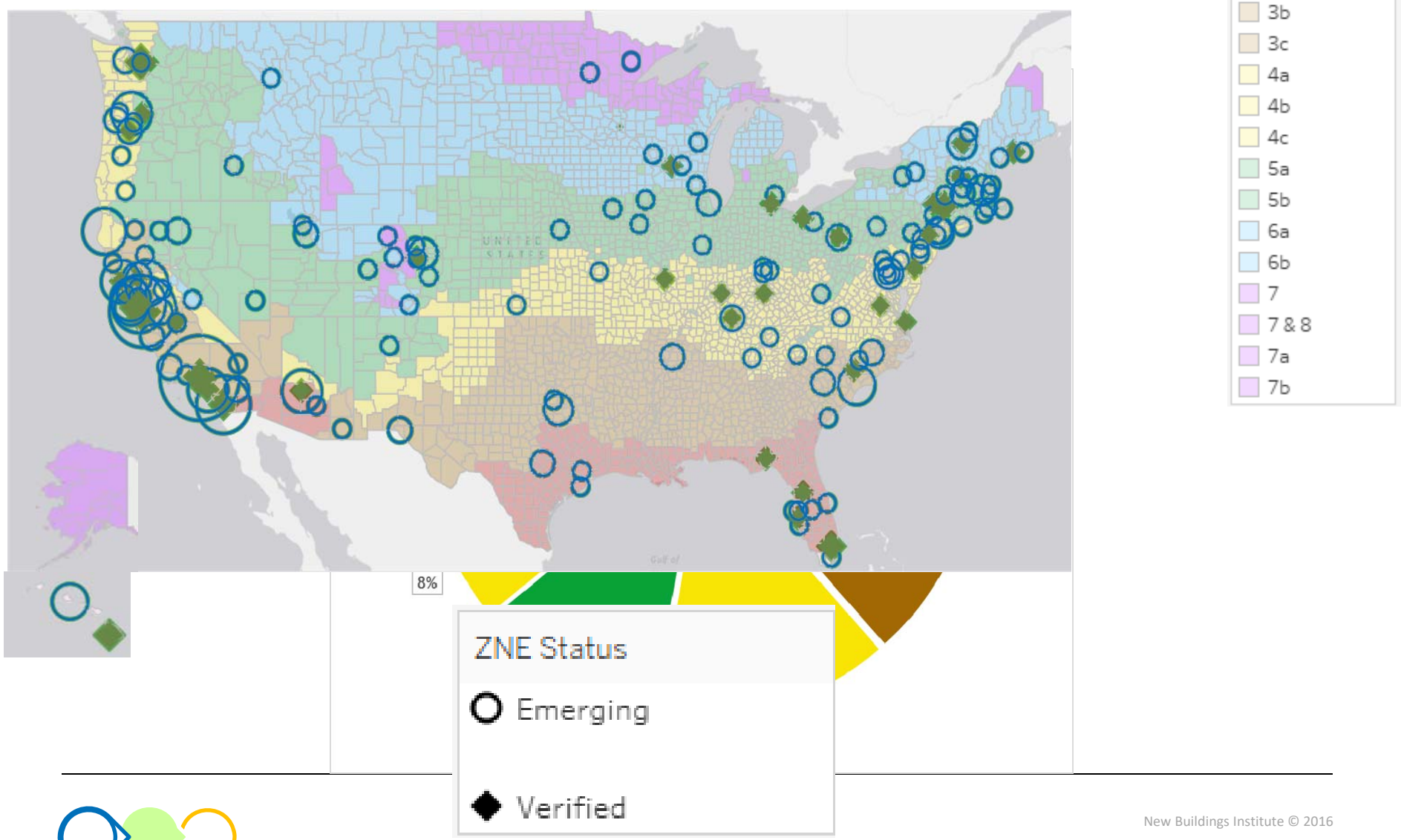
North American Locations



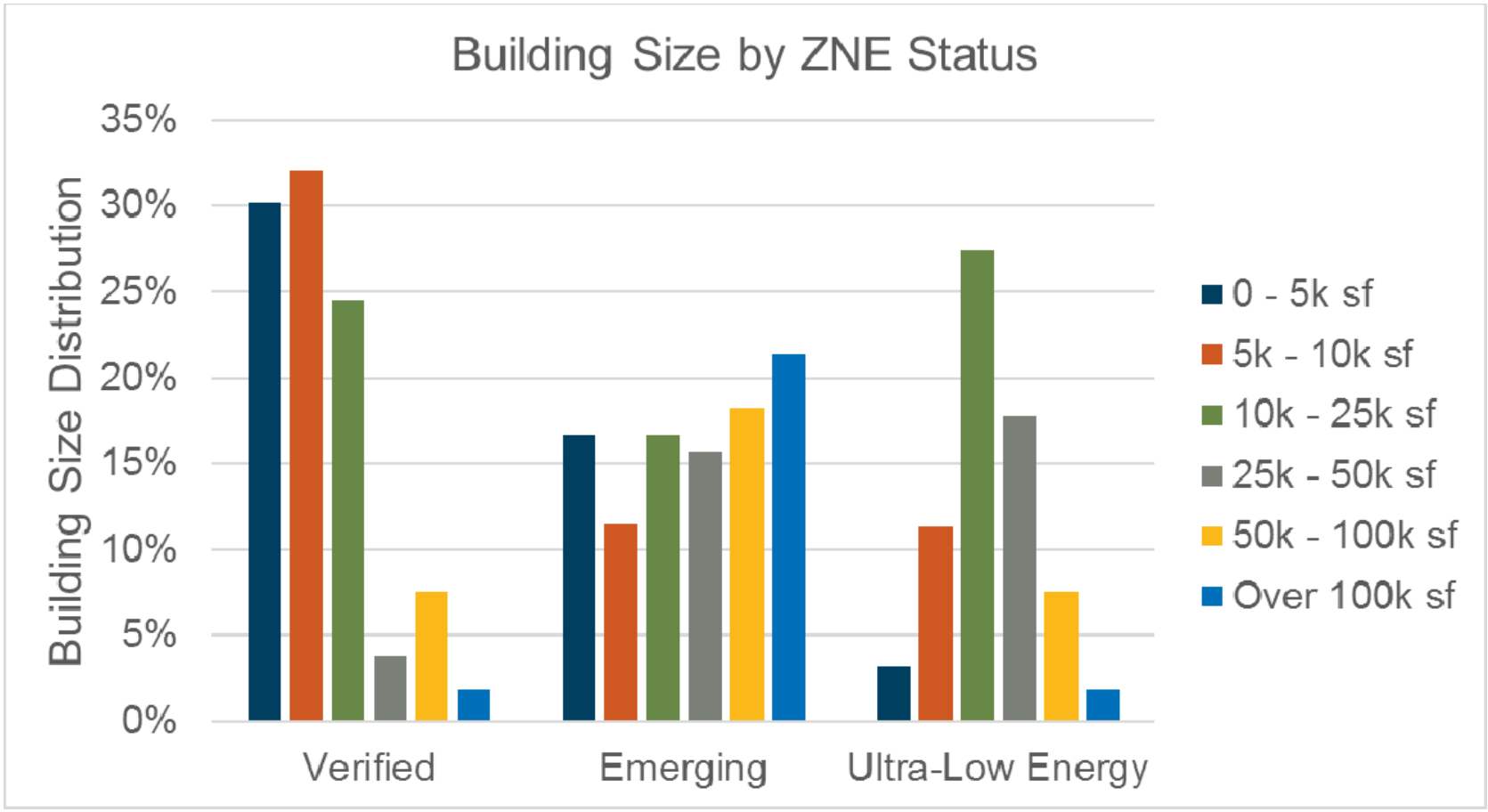
Number of ZNE Verified Buildings

States and Provinces with
ZNE Emerging or Verified Buildings (44)

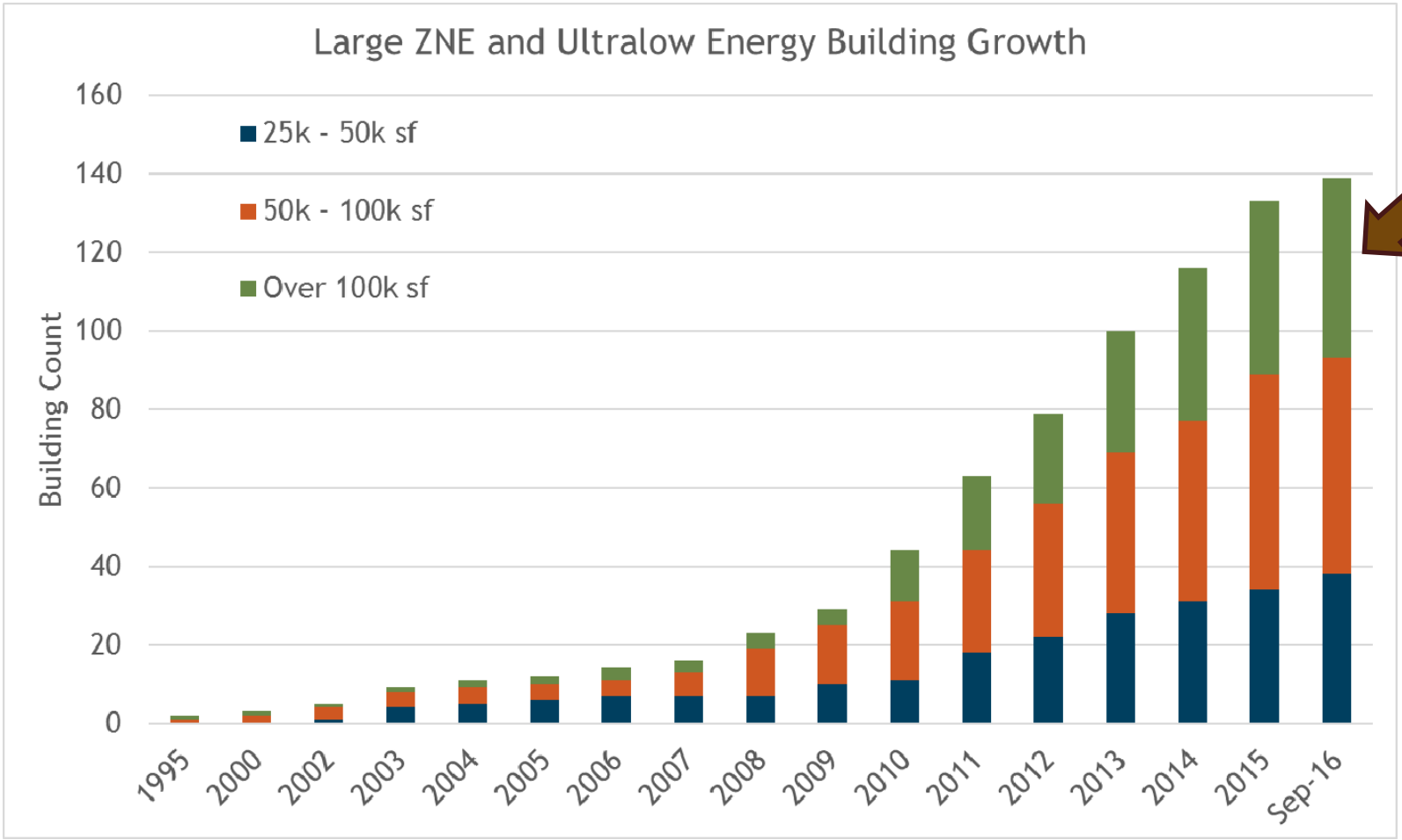
ZNE Buildings by CZ



ZNE – Now Available in Your Size



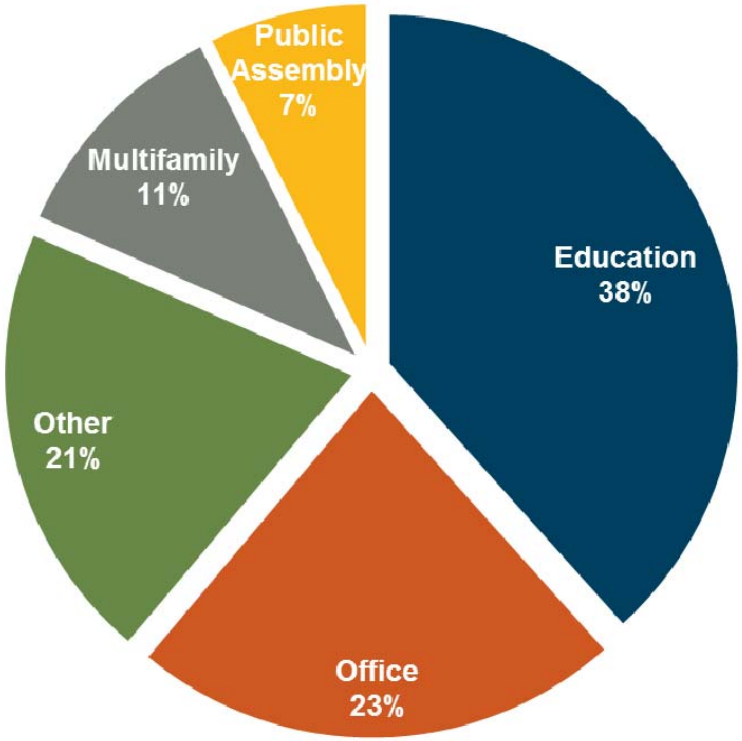
ZNE – Now Available in Your Size



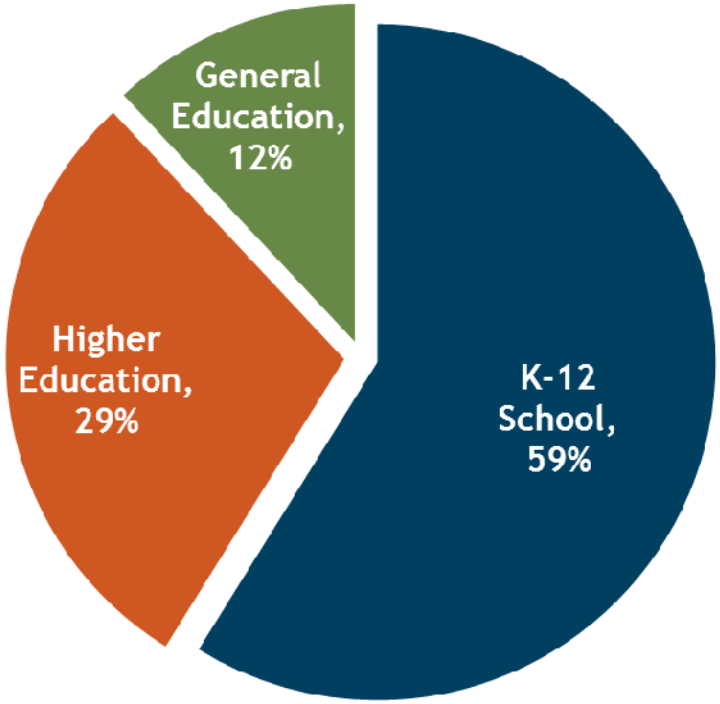
100k + sf

Building Types: Schools Lead

ZNE and Ultra-low Energy Building Types



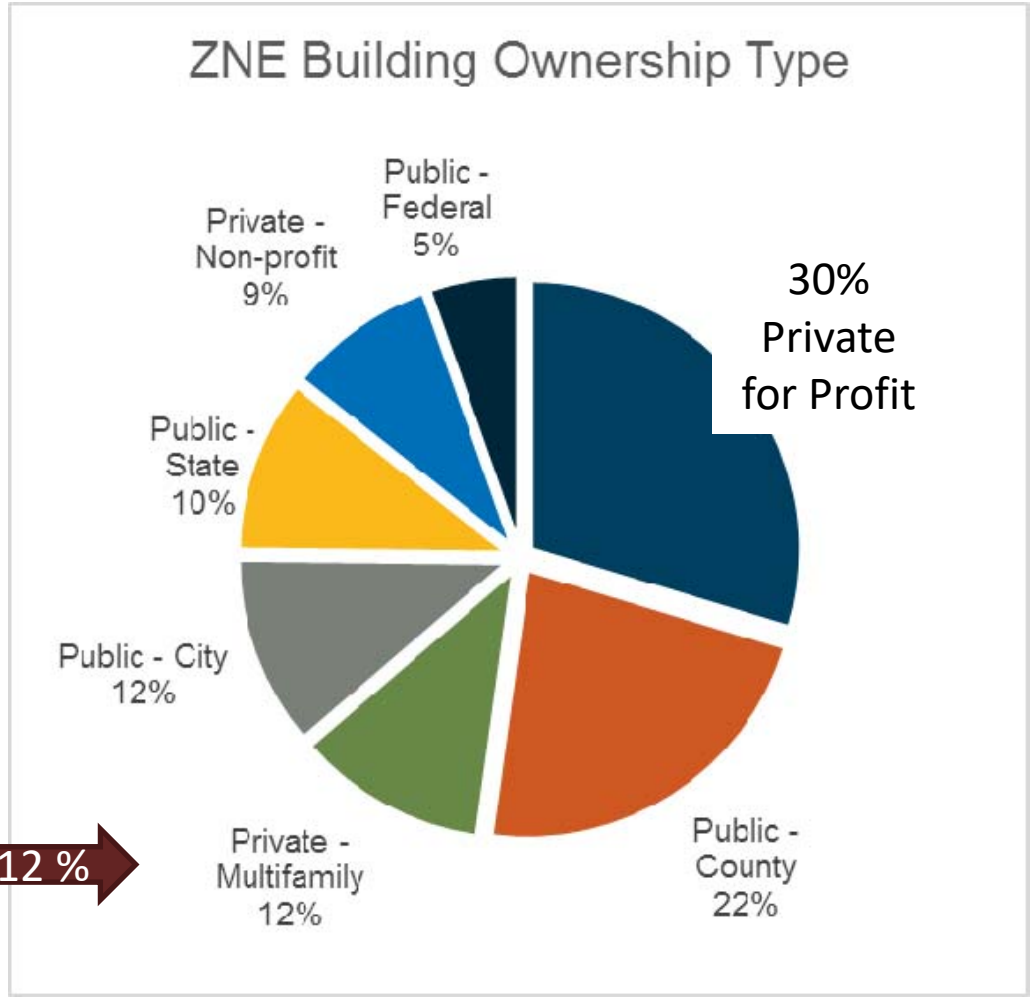
Breakdown of Education Building Types



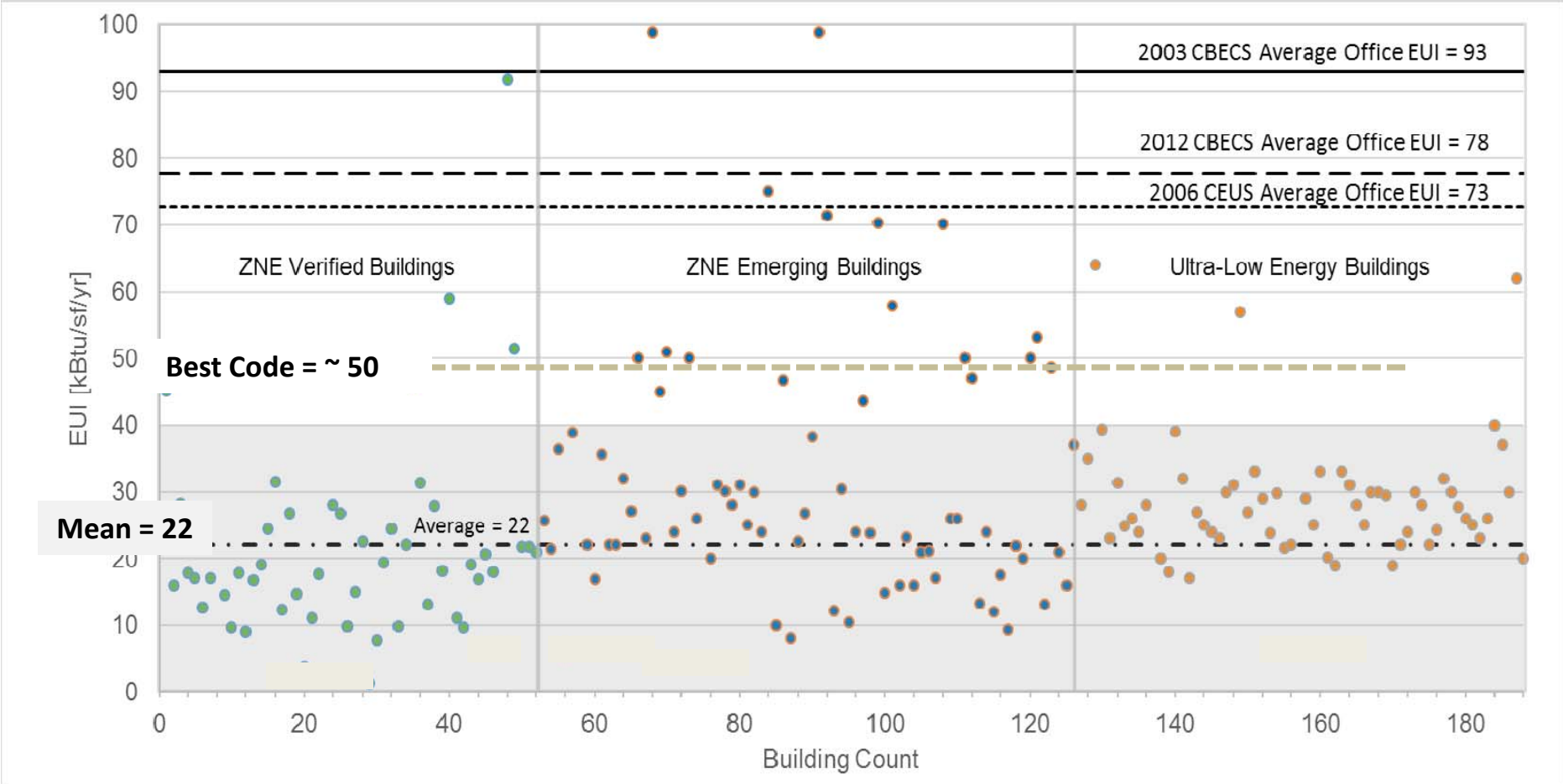
ZNE Schools: Top Five States

State	ZNE Verified	ZNE Emerging	Ultra-Low Energy Verified	Grand Total
CA	1	18	6	25
KY	2	3	4	9
NC	1	4	2	7
TX	0	5	1	6
SC	0	5	0	5
Total	**9**	**50**	**19**	**78**

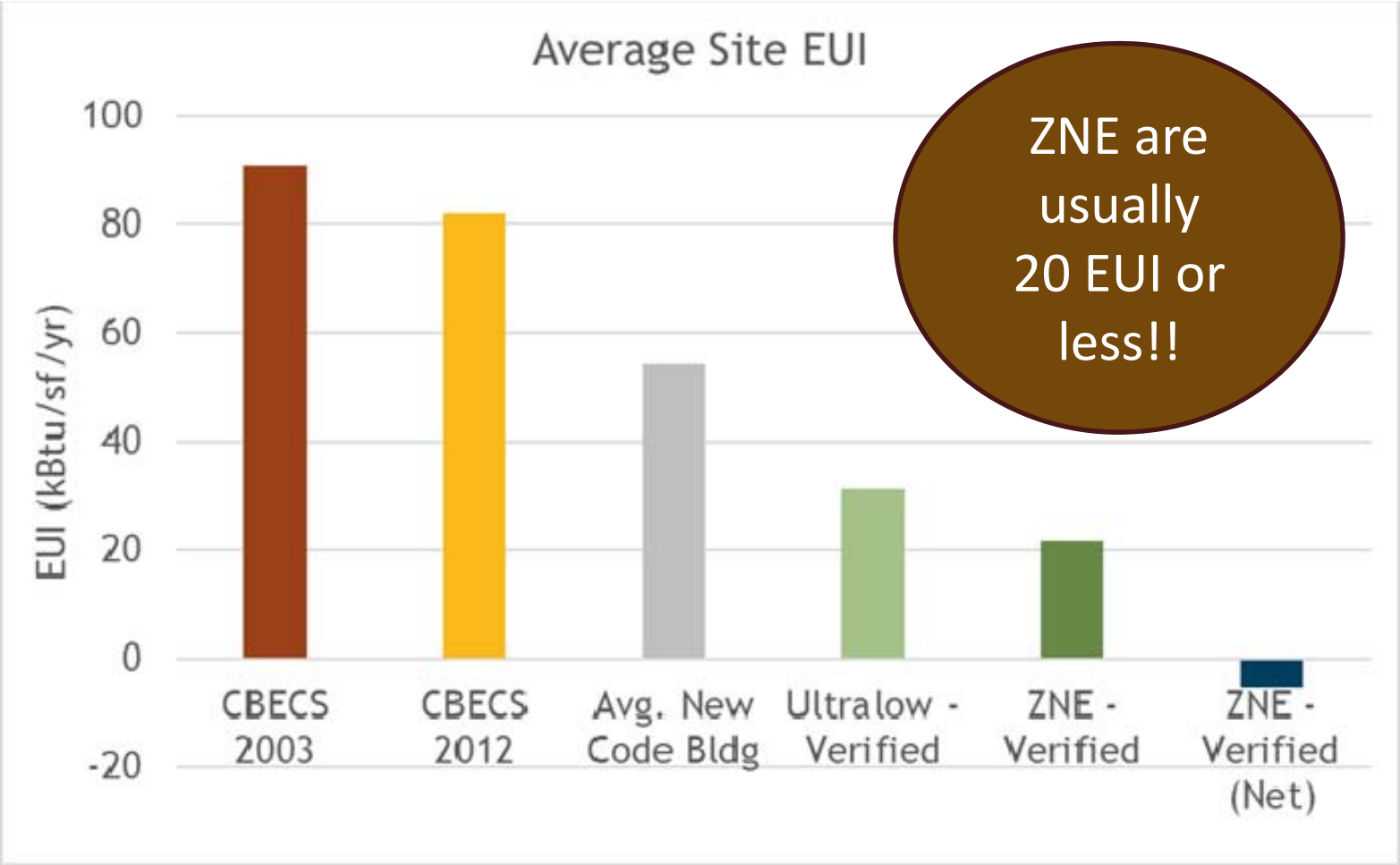
But Private is Growing



Gross EUI Performance Ranges



Energy Performance

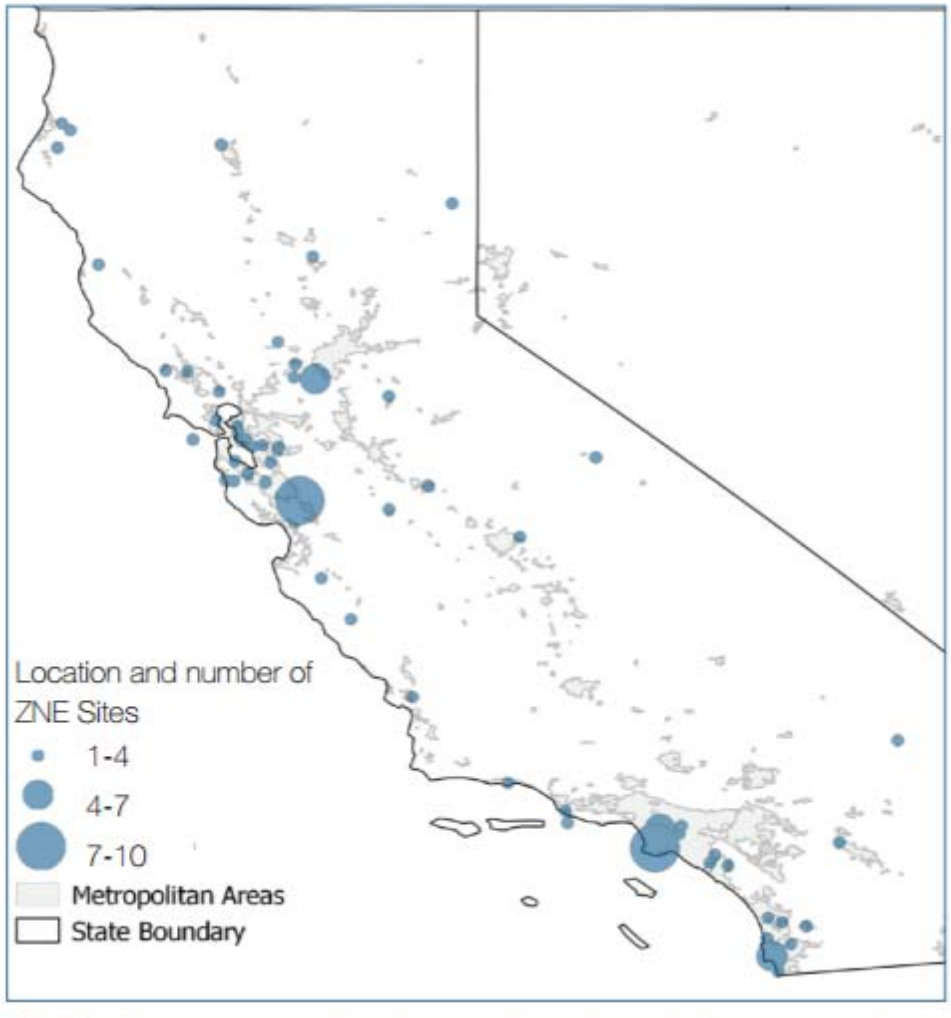


zero net energy

California ZNE Watchlist

Zero Energy & Ultra-Low Energy Buildings

energy upgrade CALIFORNIA



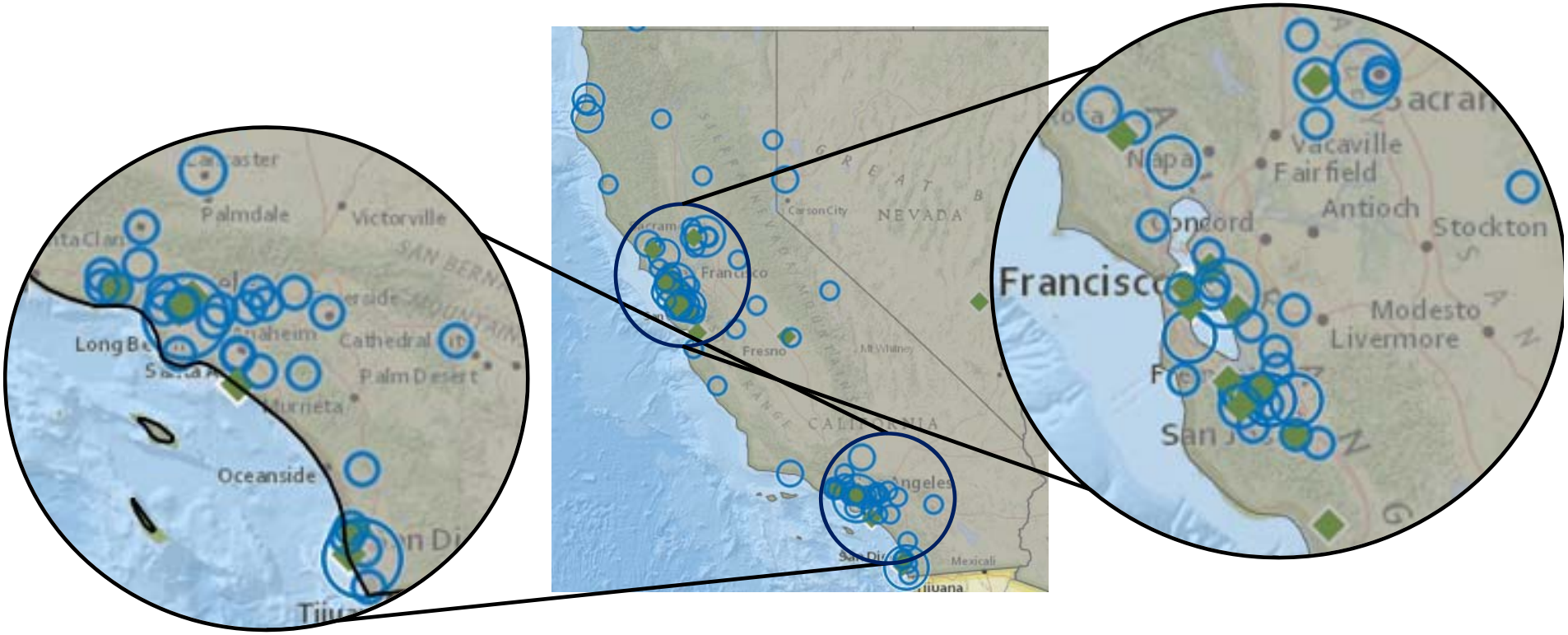
Next update count:

CA Emerging = 119

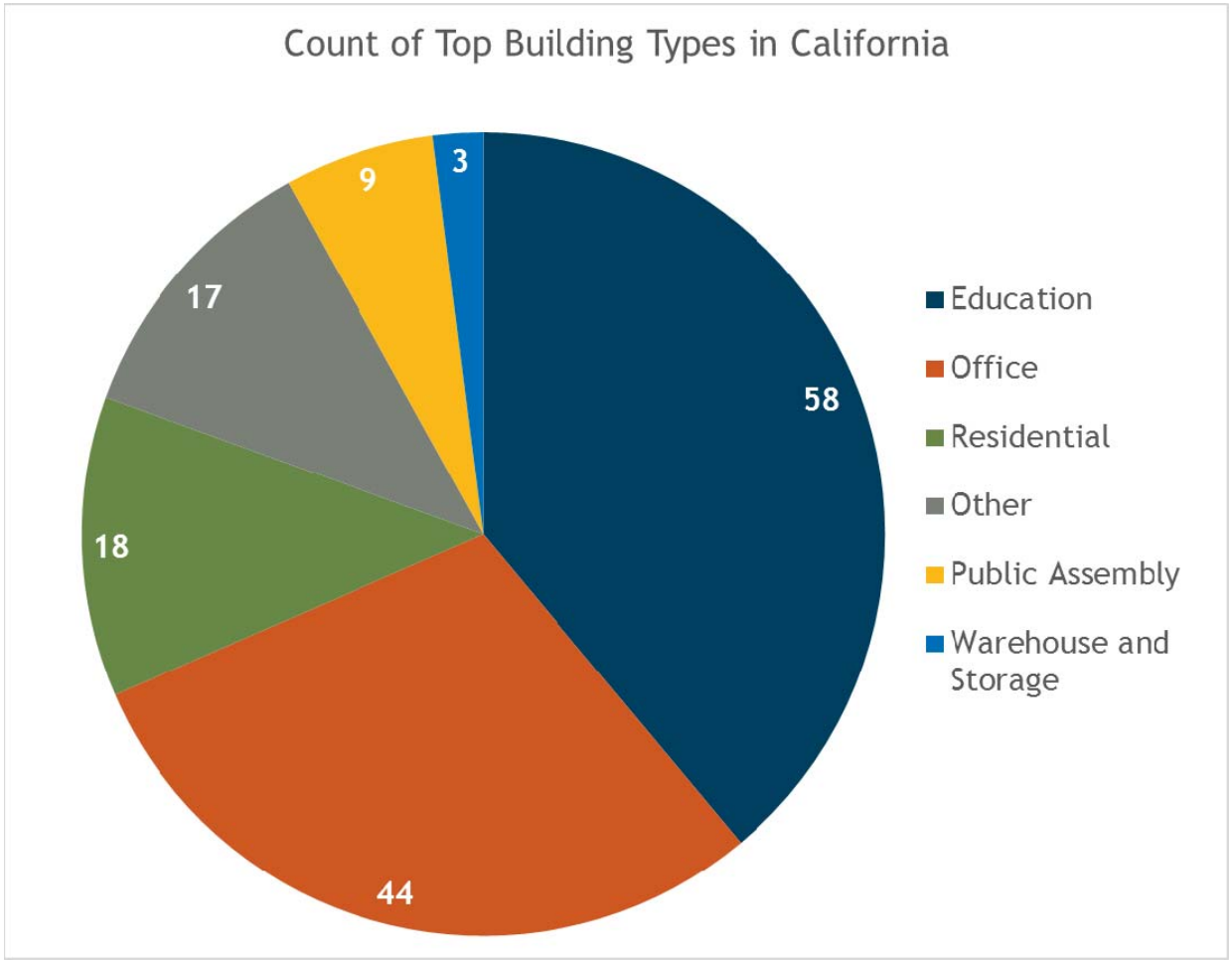
CA Verified = 18

Total = 137

ZNE Buildings in California



California Building Types



Methods

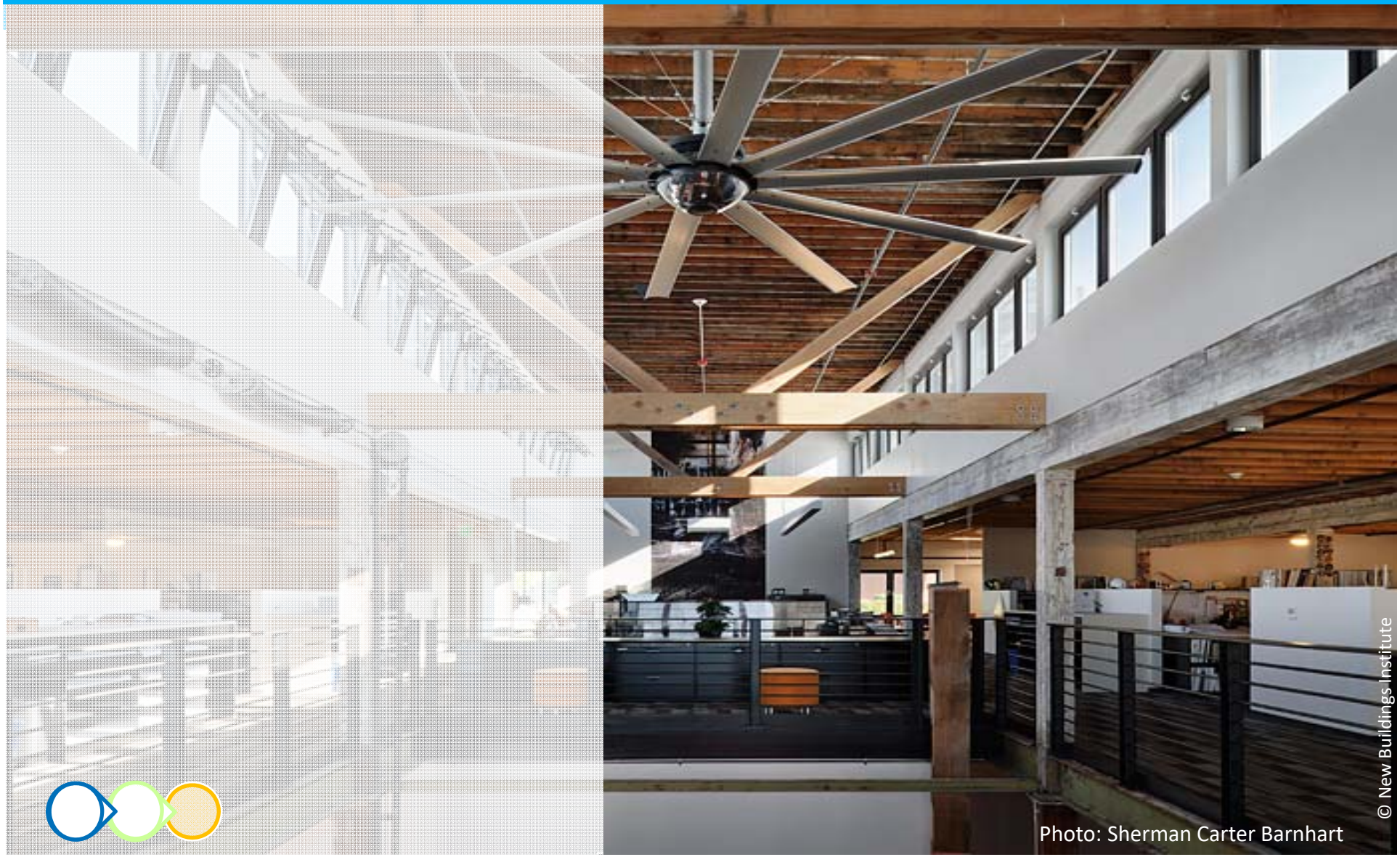
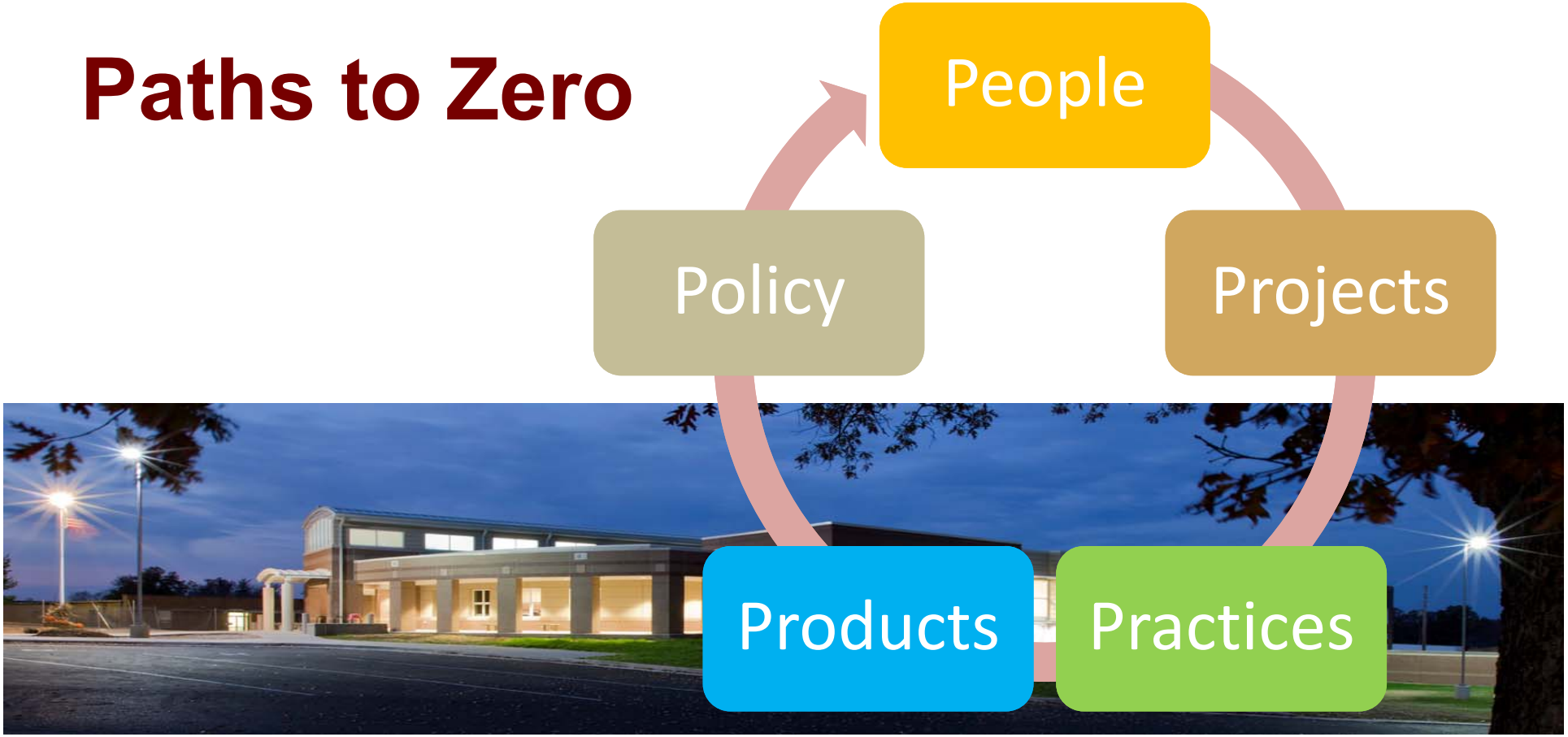


Photo: Sherman Carter Barnhart

Paths to Zero



Passive First

West Façade: Edith Green, Wendell Wyatt Federal Bldg. Portland, OR

DESIGN/ANALYSIS

WEST ELEVATION SHADING STRATEGY

Shading reduces the heat gain on the building minimizing the energy needed for cooling.

West Facade
Reeds provide avg. 50% shading

South & East Facades
Combination vertical + horizontal shades

North Facade
No shading

Courtesy: SERA Architects

Apply Common Technologies for Ultra-low Energy

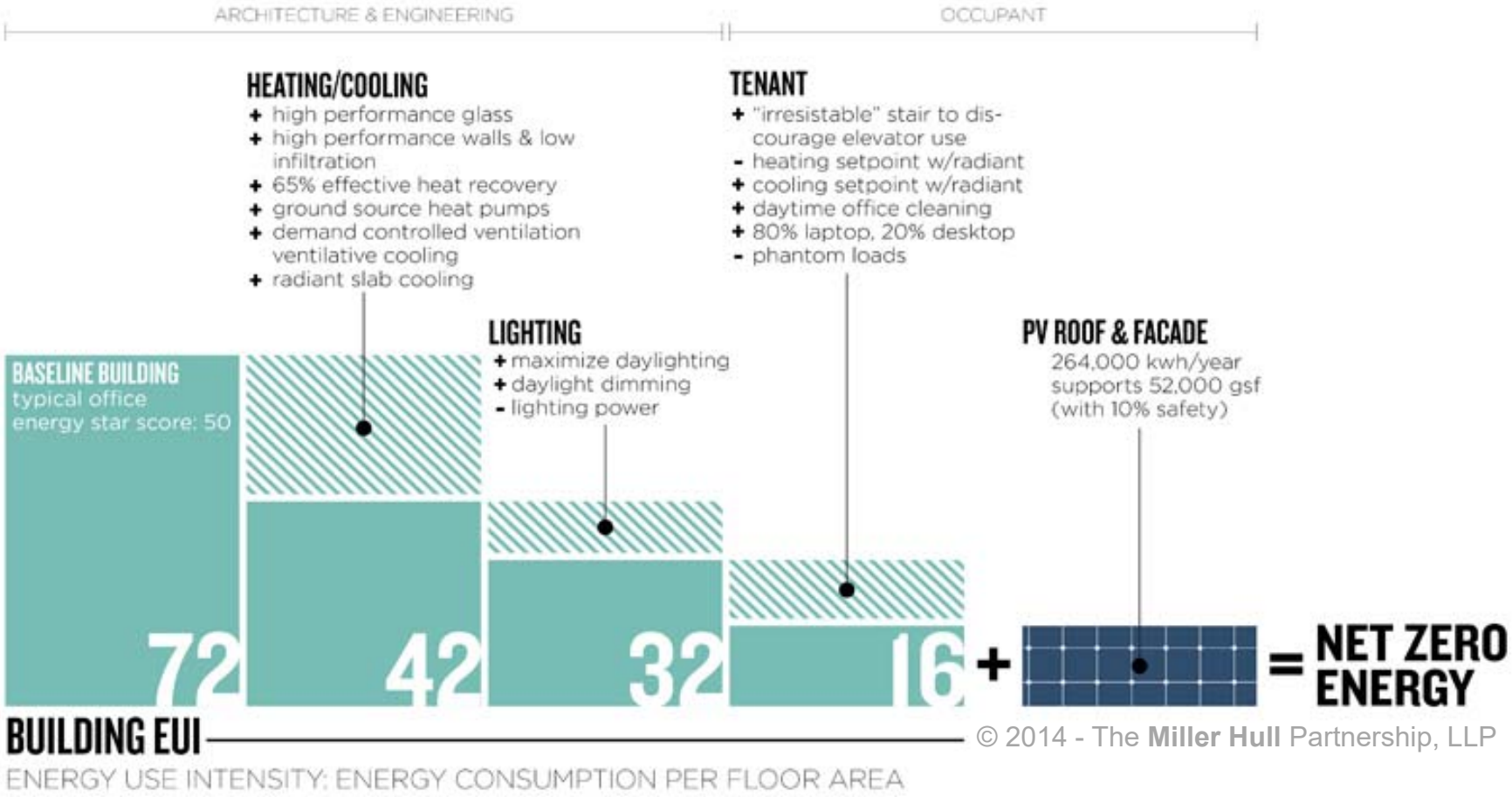
- Ground Source Heat Pumps
- Ventilation: Natural, Dedicated Outdoor Air Systems (DOAS), Demand Control Ventilation (DCV)
- Highly Efficient Thermal Envelope
- Building Orientation & Glazing ratio
- Solar Control - shading
- Daylighting Access and Controls
- Energy Management Systems
- Building Dashboards
- Radiant Heating/Cooling & Chilled Beams
- Plug load Reductions
- Energy Recovery Systems

Redding School for the Arts, CA

Courtesy : Trilogy Architecture Steve Whittaker Photography

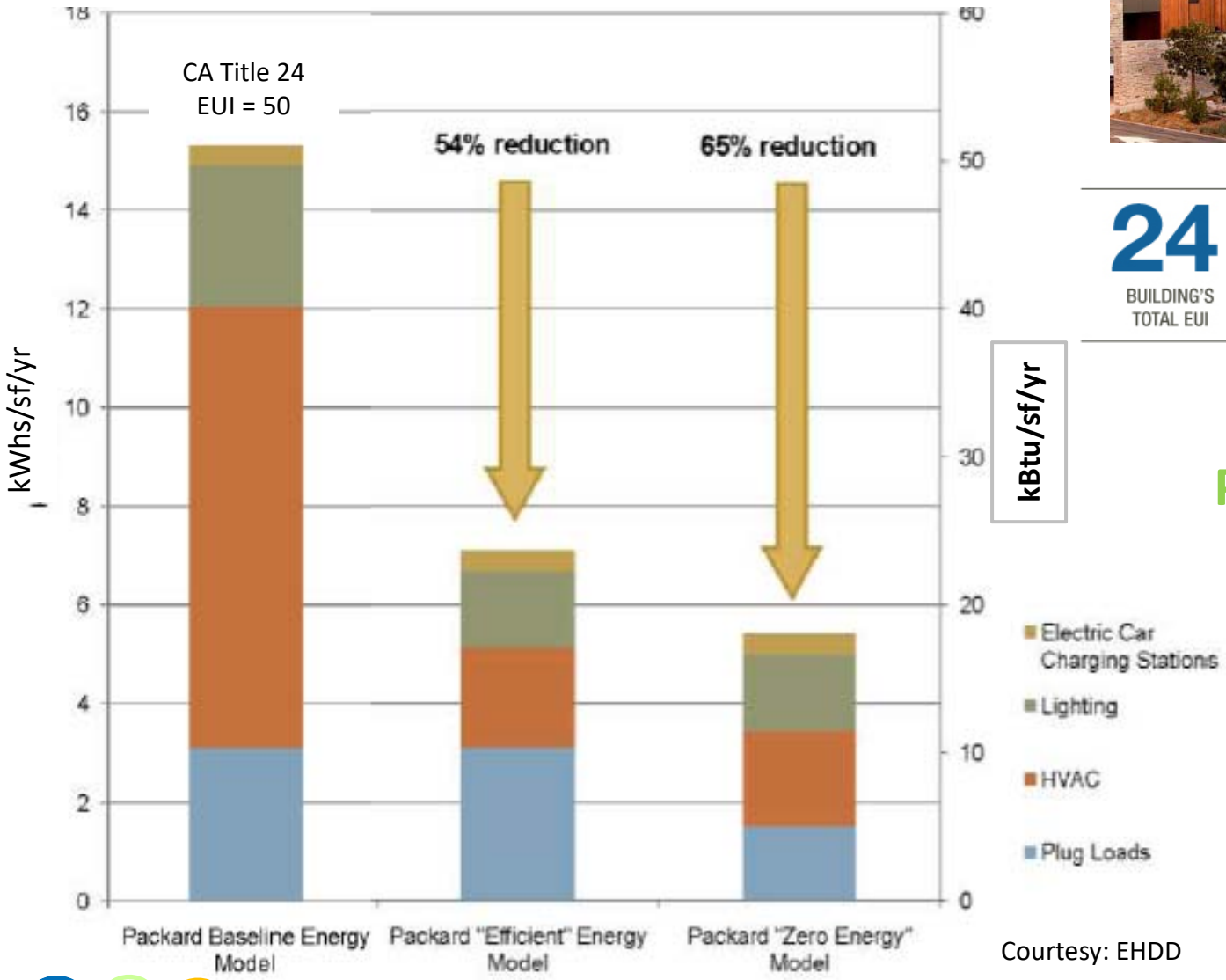
Develop and Integrate EEMs

– Working from the solar and energy budget



Packard Building

Target: 18 kBtu/sf/yr (EUI)



24 - **28** = **-4**

BUILDING'S TOTAL EUI | RENEWABLE PRODUCTION EUI | BUILDING'S NET EUI

Actual Performance

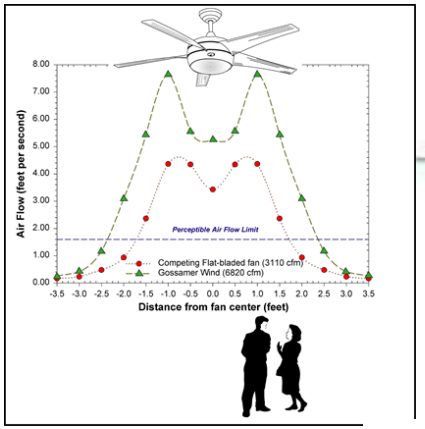
Courtesy: EHDD

SPACE CONDITIONING

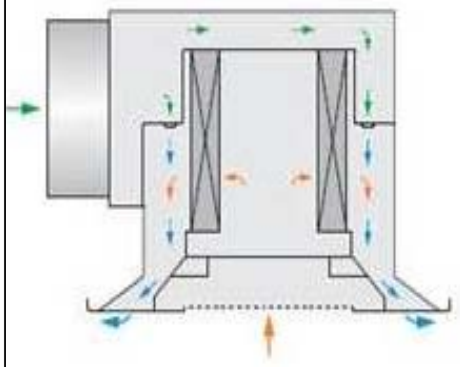
Trend: Decouple Space Conditioning from Ventilation

RADIANT SYSTEMS

EVAPORATIVE COOLING



CEILING FANS

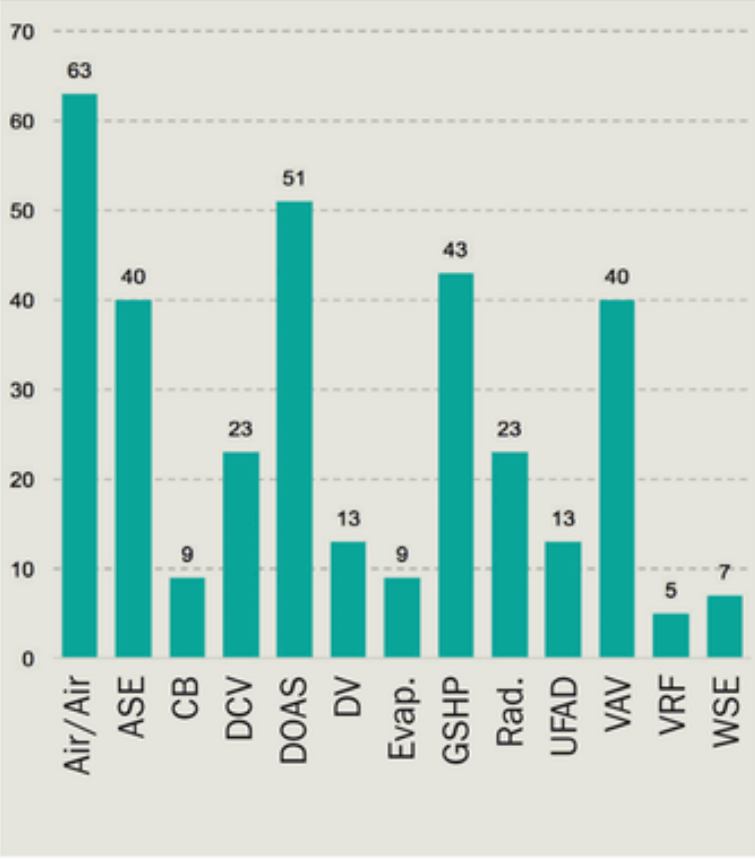


CHILLED BEAMS

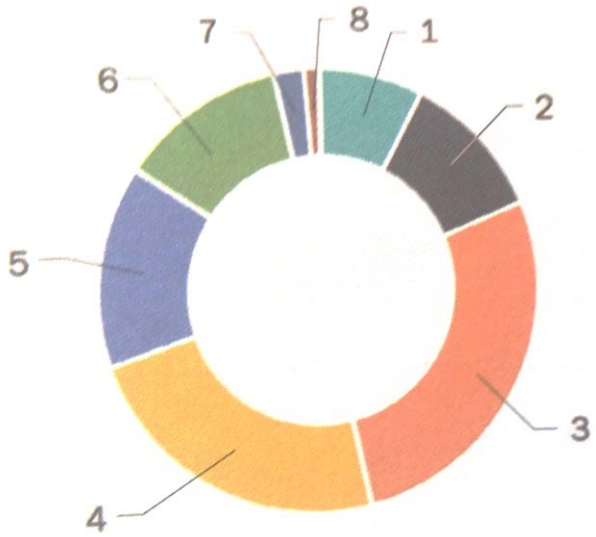
Some imaged courtesy of Stantec

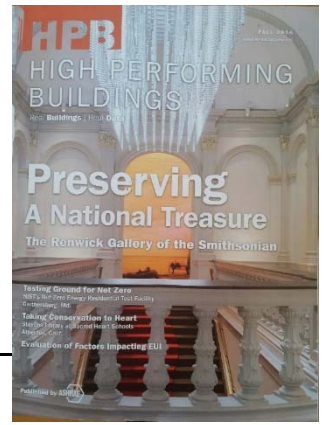
Evaluation of Factors Impacting EUI FROM HIGH PERFORMING BUILDING CASE STUDIES

Figure 10
NUMBER OF CASE STUDIES WITH EACH HVAC SYSTEM TYPE



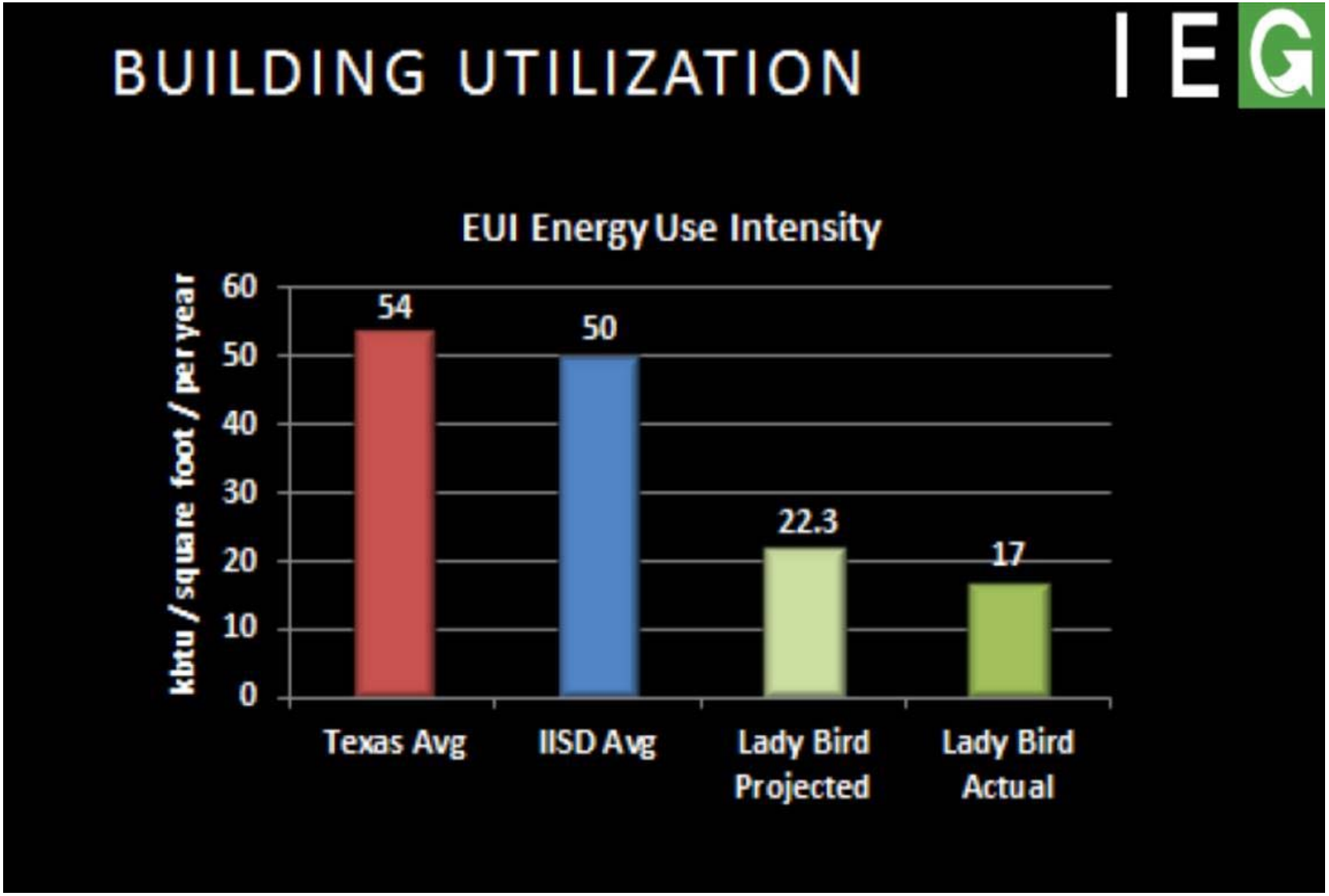
Number of HVAC Technologies per Case Study





ASHRAE HP Magazine Fall 2016

BUILDING UTILIZATION



46% Less energy in the schools with GSHP + ERV + Efficient Lighting + Insulation Package

What Resources are Available for CA?

zero net energy

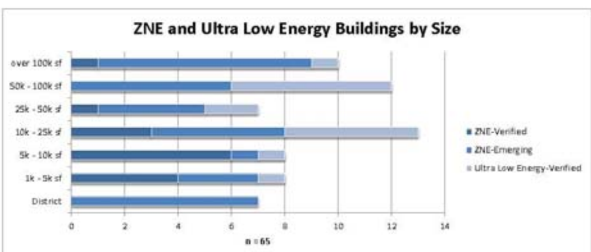
California ZNE Watchlist

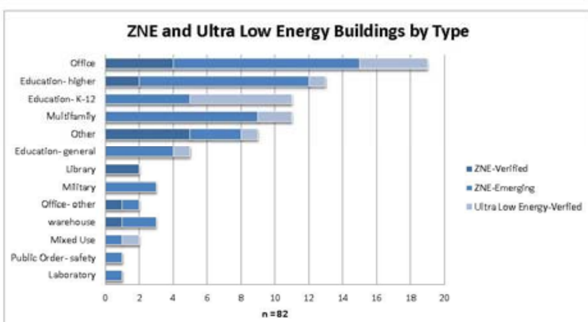
energy upgrade CALIFORNIA

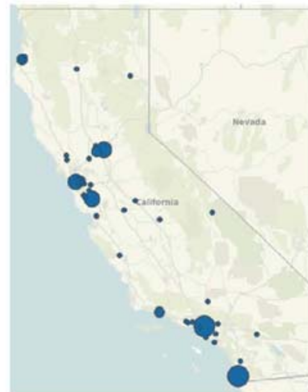
California leads the country in both policy and projects that are laying the path to a zero net energy (ZNE) future. California state agencies have adopted goals for 100% of new and 50% of existing commercial buildings to be ZNE by 2030. Leading design firms and owners have already recognized the real estate and occupancy advantages of these high performance buildings and today California has over 50 commercial buildings either verified (15) as ZNE or emerging (34) toward that target.

This CA ZNE Watchlist tracks commercial buildings (including multi-family) based on information gathered by New Buildings Institute (NBI) from multiple sources including designers, owners, utility programs, private and public organizations, articles, e-news, research, and commercial real estate professionals. It serves, along with other available ZNE resources[1], to support the awareness, acceptance and adoption of ZNE goals and outcomes throughout California and the nation. Buildings with ultra-low energy performance comparable to ZNE are also included.

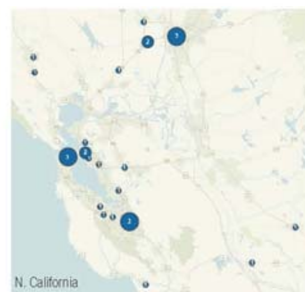
The graphics below show the trends in location, type and size of the ZNE buildings in California.



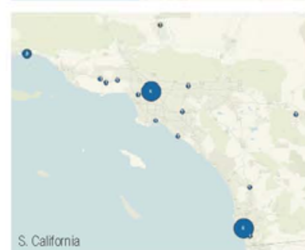




Locations of CA ZNE Verified and Emerging ZNE Building. Dot size represents volume of buildings.



N. California



S. California

[1] **For more resources:** CPUC (http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Zero+Net+Energy+Buildings.htm) and NBI (www.newbuildings.org/zero-energy)

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ZNE ACTION BULLETIN

Progress Towards Zero Net Energy Buildings

Email heather@newbuildings.org to sign up

ZNE & Ultra-Low Energy Case Studies

- CPUC & NBI ZNE Case Studies
  http://newbuildings.org/case-studies-zne-projects
- PG&E Case Studies
  http://energydesignresources.com/resources/publications/case-studies/case-studies-zne-non-residential-buildings.aspx
- NBI Registry
  http://newbuildings.org/share
- Getting to Zero Database
  http://newbuildings.org/getting-to-zero-buildings-database

Getting to Zero Workshops for ZNE Early Adopters

what part will you play in solving the greatest challenge of our time?

Oberlin College Adam Joseph Lewis Center for Environmental Studies | Oberlin, OH

Thank You!

Cathy Higgins

Reearch Director, NBI

higgins@newbuildings.org

David and Lucille Packard Foundation Building
Courtesy: EHDD