

# Pre-emption in the context of ZNE and other policies

**Jim Edelson**

DOE Codes Conference

Tucson AZ

**nbi** new buildings  
institute

redefining  
what's possible  
in the built  
environment

# Vision + Mission

We believe in a built environment that makes a positive contribution to a sustainable society through dramatic improvements in energy performance.

NBI takes leading-edge practices and technology applications for high performance buildings and translates them into innovative and practical solutions for the energy efficiency and commercial building industries.



East Boston Public Library | East Boston, MA

# Zero Net Energy Buildings

**Forbes** | New Posts | Most Popular | Lists

ENERGY | 5/05/2013 @ 5:36PM | 4,986 views

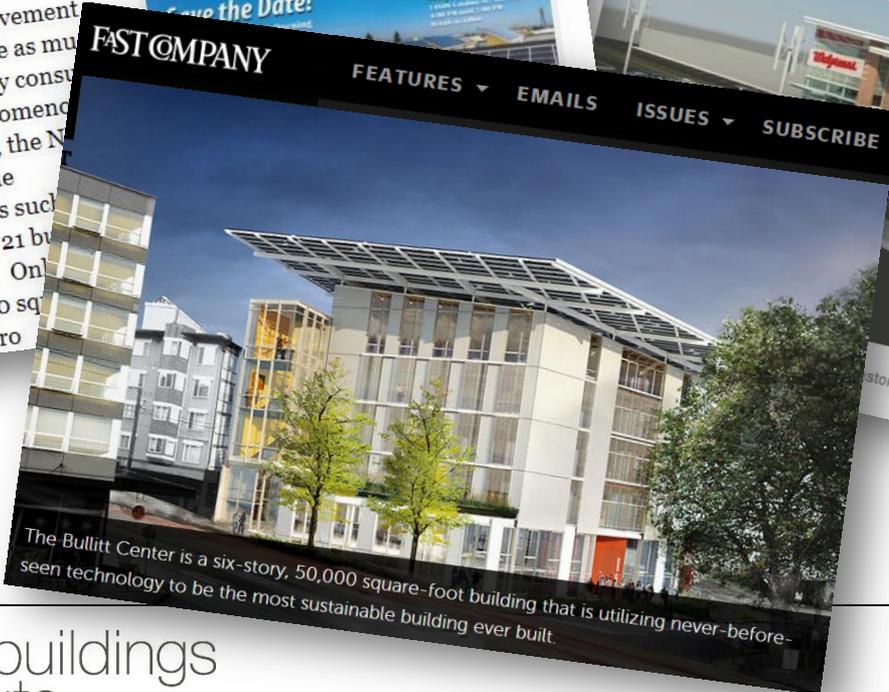
## Building The Capacity To Increase Net Zero Construction

4 comments, 2 called-out | + Comment Now | + Follow Comments

The net zero building movement (where buildings produce as much or more energy than they consume) remains a nascent phenomenon. As of this time last year, the Net Zero Buildings Institute – the organization that tracks such buildings – had recognized only 21 buildings as net zero structures. Only three of these exceeded 15,000 square feet. The concept of net zero

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Save the Date! Thursday May 20, 2015



**The New York Times**

WORLD | U.S. | N.Y. / REGION | BUSINESS | TECHNOLOGY | SCIENCE | HEALTH | SPORTS | OPINION

## Commercial

SQUARE FEET | NEIGHBORHOODS | GREAT HOMES AND DESTINATIONS | COMMERCIAL

### Close to Its Home, Walgreen Tests Energy-Saving Ideas



Cambridge, Ill., north of Chicago includes its sloping roof, which is to contain

Camurus & Theodore

# 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 ft<sup>2</sup>  
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  
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**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.](#)

### Zero Buildings Database

Search

Emerging

Net EUI\* (kBtu/ft<sup>2</sup>/yr):  At Least  Less Than

Building Size (ft<sup>2</sup>):  At Least  Less Than

Construction Type:

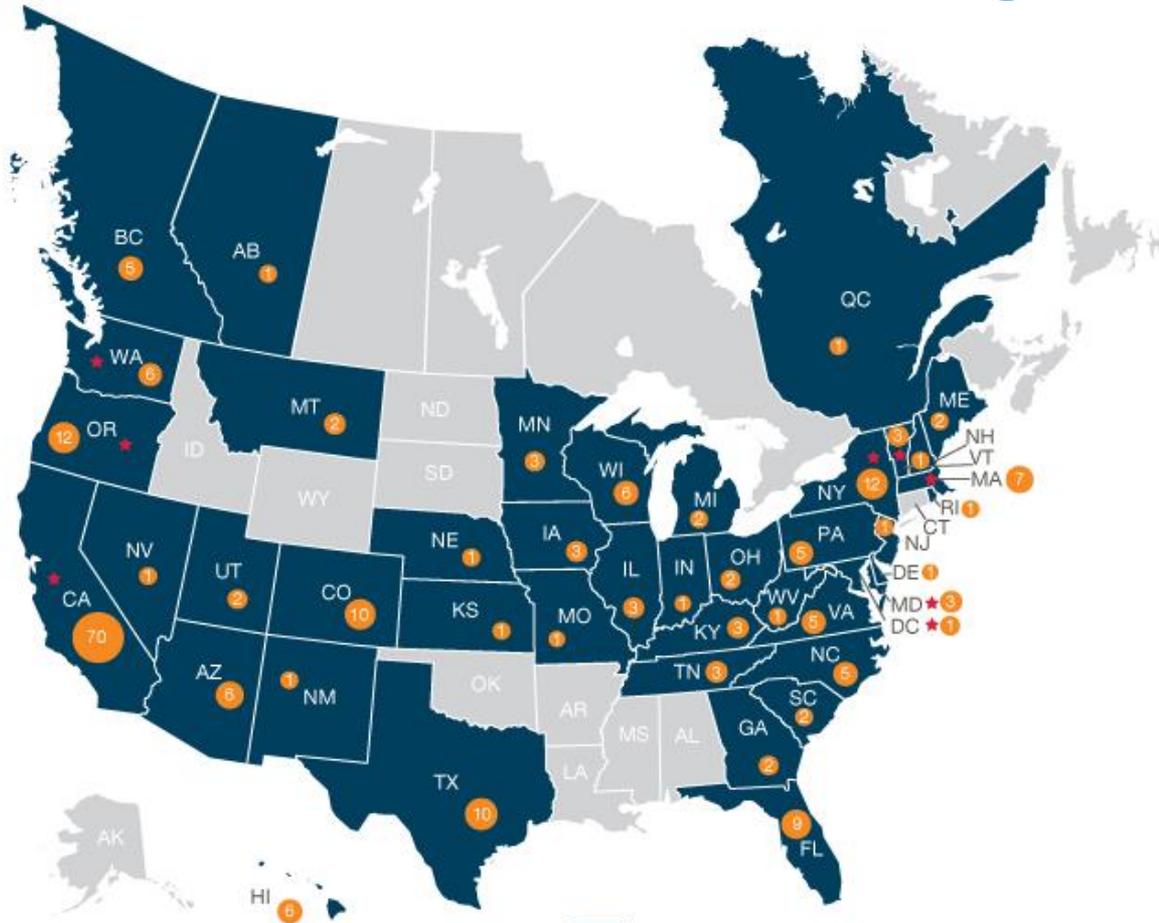
Climate: - Show  
State or Province: California

\* The Net Energy Use Intensity (EUI) includes both whole-building energy usage and on-site renewable energy generation. ZNE buildings will have an EUI of zero or less (if generation exceeds use). See each project's energy section.

	City	State	Area (ft <sup>2</sup> )
<b>Center at Debs Park</b>	Los Angeles	CA	5027
<b>Offices</b>	San Diego	CA	4499
<b>ers Tennis Club for Boys and Girls</b>	Los Angeles	CA	3498
<b>atsonville Water Resources Center</b>	Watsonville	CA	19795
<b>d Lucile Packard Foundation</b>	Los Altos	CA	48997
<b>X Ranch Student Intern Center at Santa Monica Recreation Area</b>	Malibu	CA	3498
<b>struction San Diego Net Zero Office</b>	San Diego	CA	33390
<b>mental Technology Center at Sonoma State</b>	Rohnert Park	CA	2196
<b>Squared Design Facility</b>	San Jose	CA	6555
<b>ao-ming Sun Field Station at Jasper Ridge</b>	Woodside	CA	13107

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

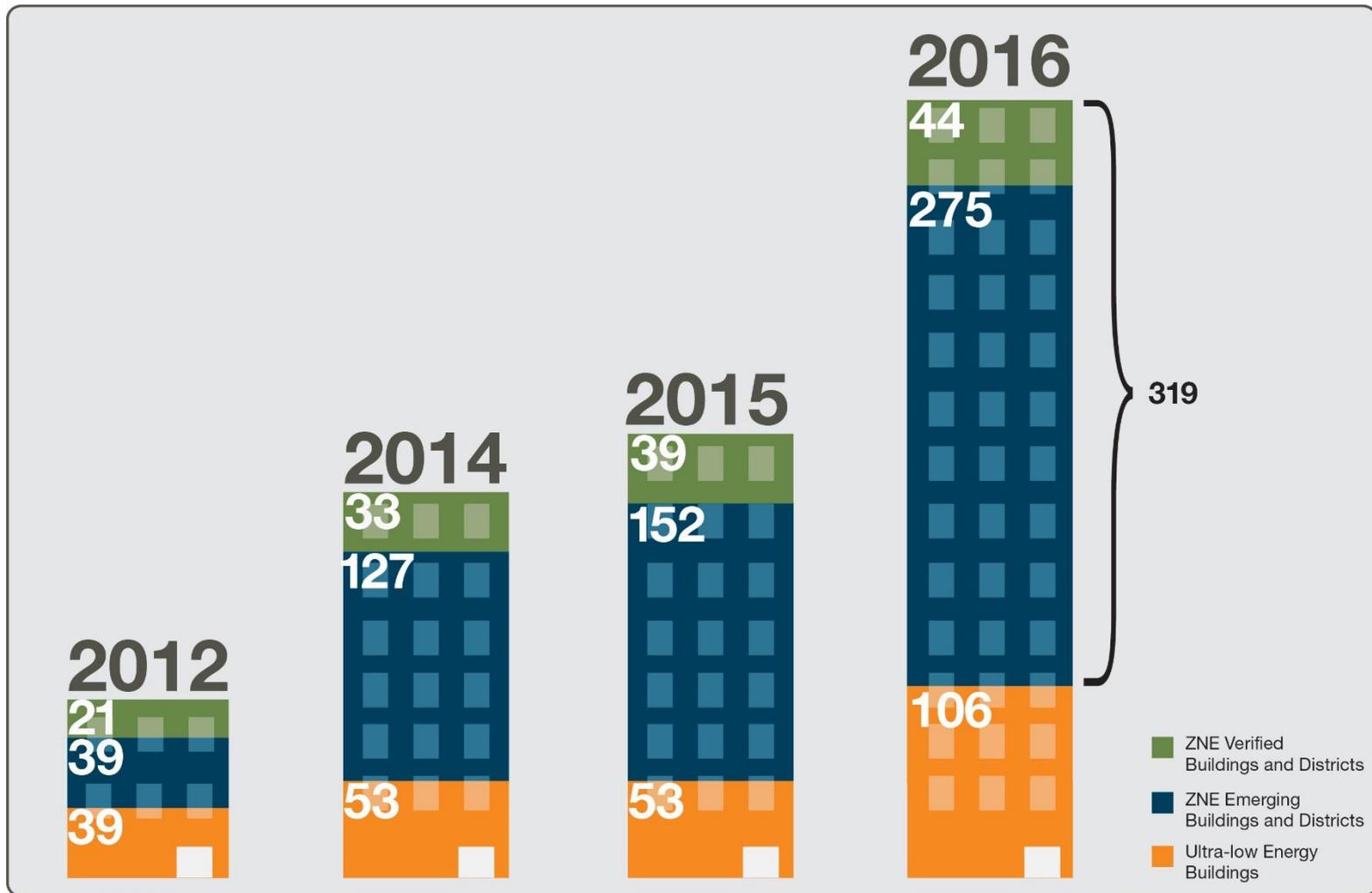


# Number of Buildings and projects (225)

■ ZNE Emerging and/or Verified Buildings (42 states and provinces, and the District of Columbia)

★ States with Reach Code Adopted or in Development

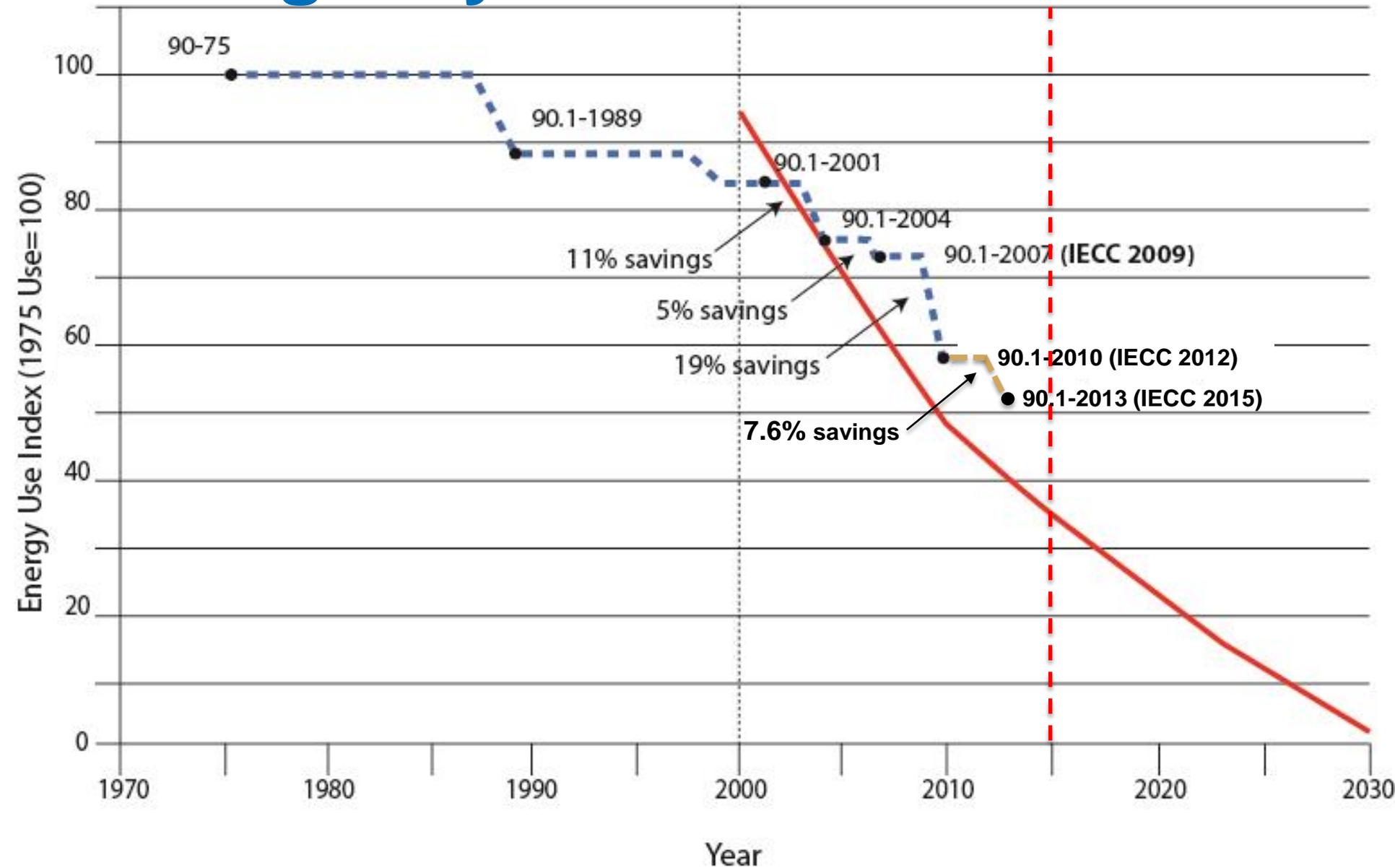
# Number of ZNE Projects–2016



Courtesy of New Buildings Institute | [newbuildings.org](http://newbuildings.org)

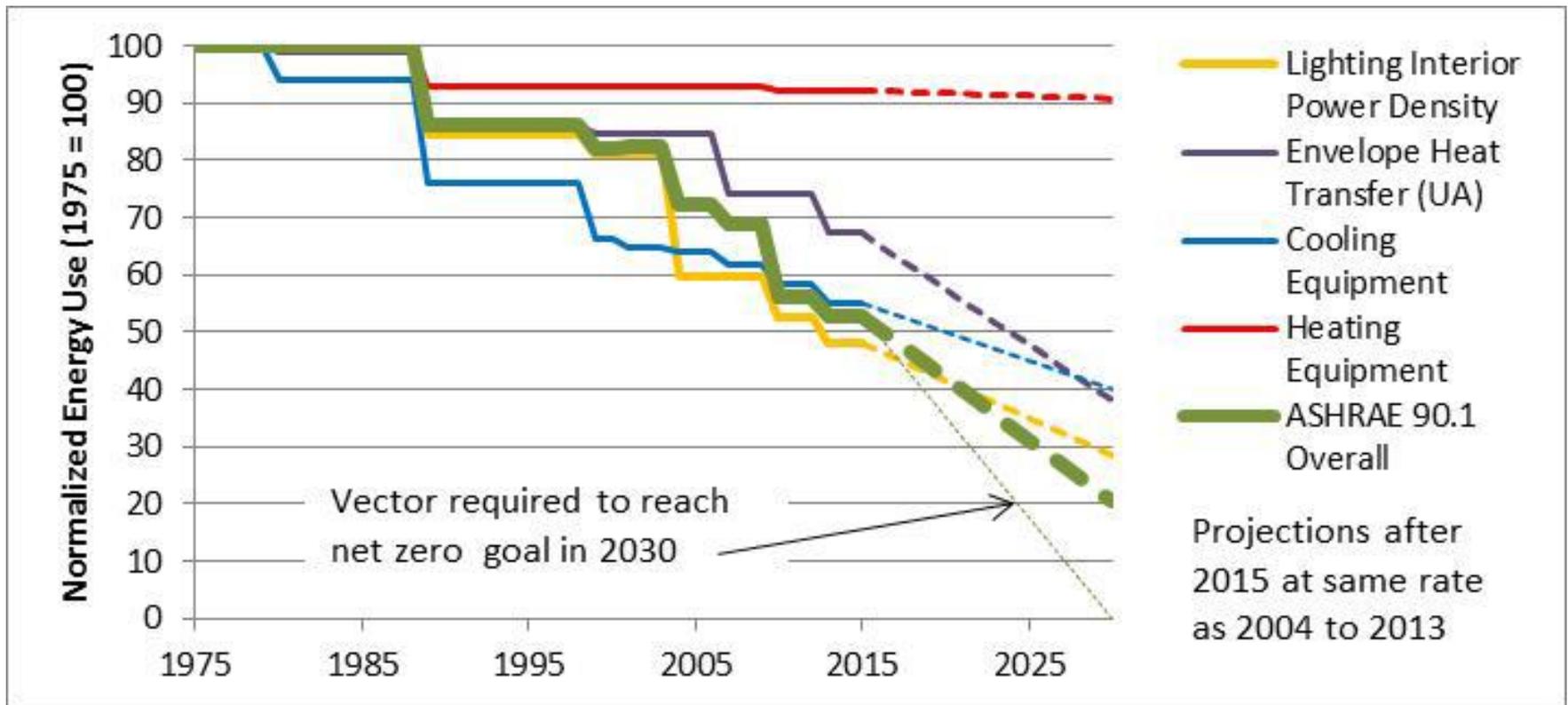
# Advancing Energy Code Stringency

- Year 2000 Baseline
- A2030 Goals
- Code Stringency



# A Range of End Use Challenges

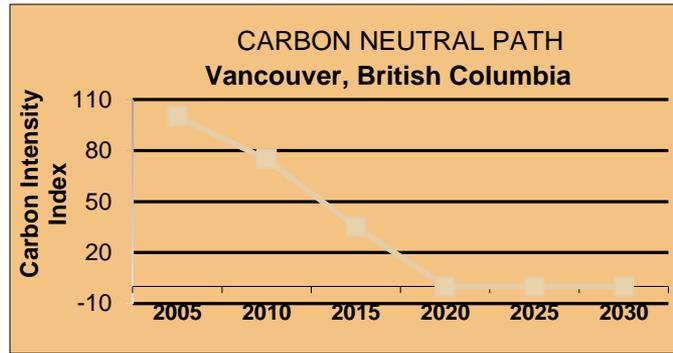
(graph - PNNL)



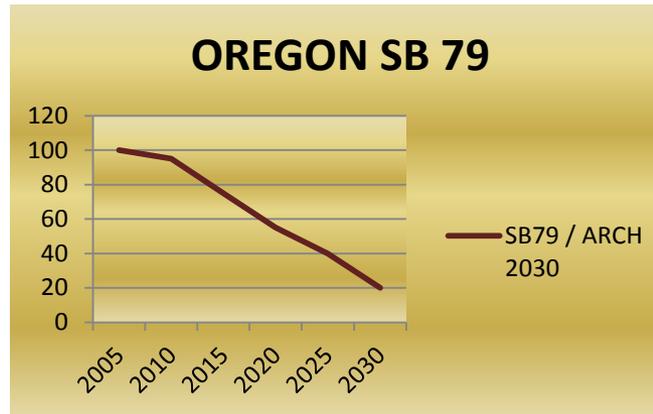
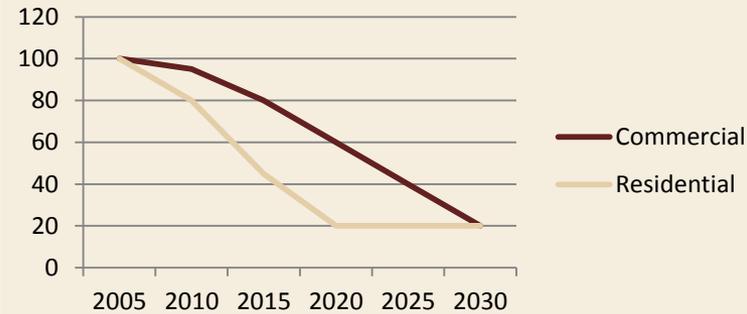
# GETTING TO ZNE

## Tools for the Policy:

1. Goals and Definitions
2. Market Readiness
3. Public Buildings
4. Case Studies
5. Outreach to Stakeholders
6. Emerging issues – DG, EV, etc...
7. Engagement w/ Energy Utilities

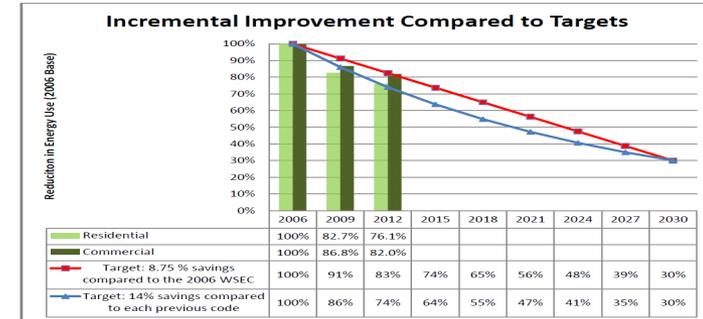


## California: Big Bold Goals

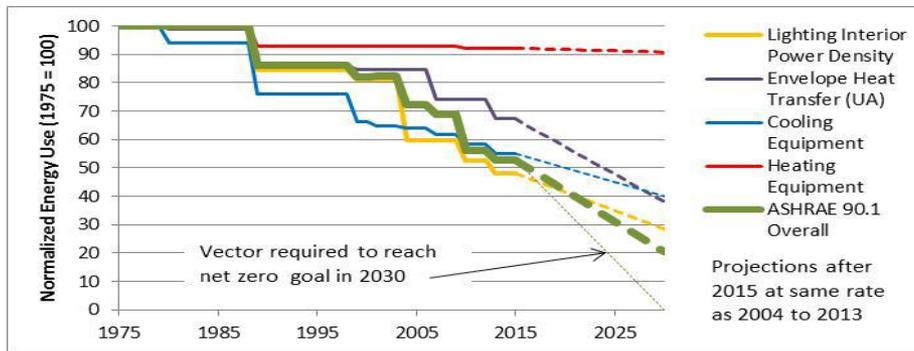


## WASHINGTON: SB 5854

Incremental Improvement Compared to Targets

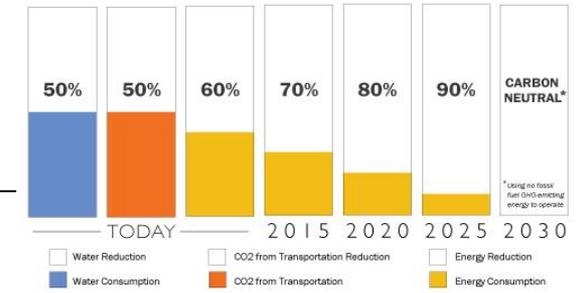


## ASHRAE 90.1 – Energy Use Targets

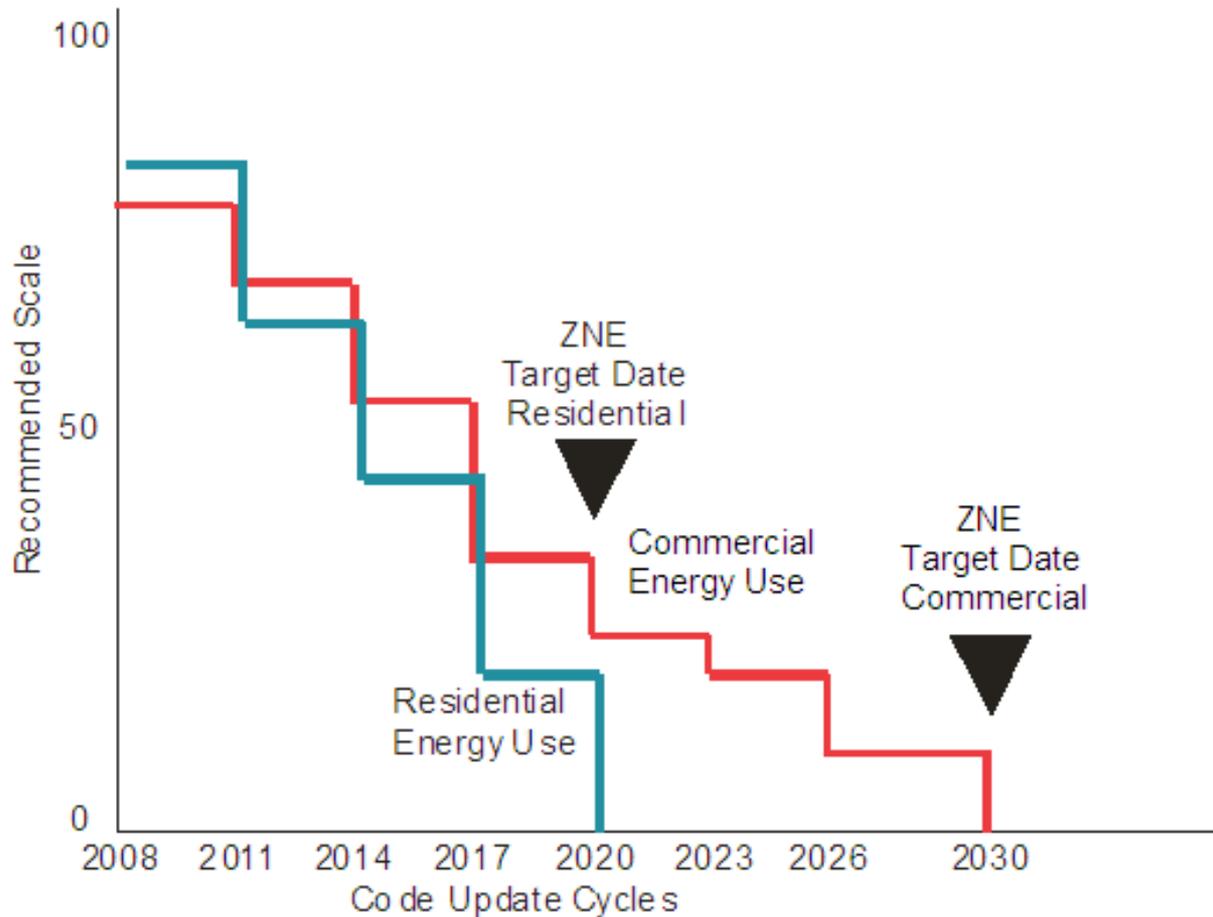


## Applying Carbon Metrics

Seattle EcoDistrict and Architecture 2030  
Carbon to Site EUI = 1.23 lbs CO2 per BTU



# Code Cycles to Net Zero in CA



Code Cycles to ZNE, Source: SCE & AEC, 2009

# SB 350 (2015) – Existing Buildings

- Double the planned level of savings from energy efficiency improvements in existing buildings
- Andrew McAllister, a member of the California Energy Commission, said older apartment buildings would be particularly challenging. “What we're trying to do is facilitate, where necessary, the marketplace for energy efficiency, for building upgrades, for remodels,” he said.

# Pacific Coast Collaborative

## 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.

# Pacific Coast Collaborative

## PACIFIC COAST

### III. Invest in clean energy and climate-resilient infrastructure with actions to:

- 1) Transform the market for energy efficiency and lead the way to “net-zero” buildings.

Energy efficiency is the lowest cost way to reduce greenhouse gas emissions while creating good local jobs. The governments of California, British Columbia, Oregon and Washington will work to harmonize appliance standards, increase access to affordable financing products, and support policy that ensures that energy efficiency is valued when buildings are bought and sold. Our efforts intend to build a vibrant, growing regional market for energy efficiency products and services.

**WASHINGTON  
ENGROSSED SECOND  
SUBSTITUTE SENATE BILL 5854  
61st Legislature  
2009 Regular Session**



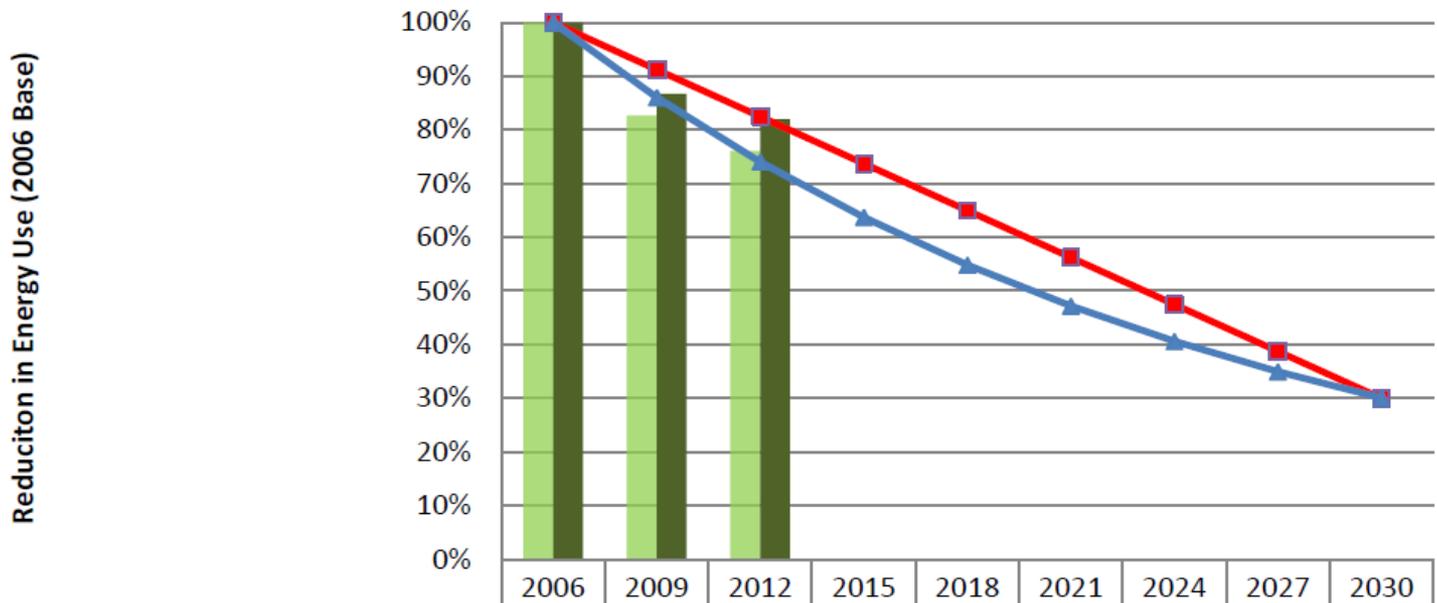
**Key Concepts**

**Sec. 5. (1) Except as provided in subsection (2) of this section, residential and nonresidential construction permitted under the 2031 state energy code must achieve a seventy percent reduction in annual net energy consumption**, using the adopted 2006 Washington state energy code as a baseline.

(2) The council shall adopt state energy codes from 2013 through 2031 that **incrementally move towards achieving the seventy percent reduction in annual net energy consumption** as specified in subsection (1) of this section. The council shall report its progress by December 31, 2012, and every three years thereafter.

# WA Code Roadmap: Code Improvement Targets

## Incremental Improvement Compared to Targets



	2006	2009	2012	2015	2018	2021	2024	2027	2030
<span style="color: #92d050;">■</span> Residential	100%	82.7%	76.1%						
<span style="color: #4b611c;">■</span> Commercial	100%	86.8%	82.0%						
<span style="color: #d62728;">■</span> Target: 8.75 % savings compared to the 2006 WSEC	100%	91%	83%	74%	65%	56%	48%	39%	30%
<span style="color: #1f77b4;">▲</span> Target: 14% savings compared to each previous code	100%	86%	74%	64%	55%	47%	41%	35%	30%

## Washington State Energy Code Roadmap

*Issues, priorities and sequences that will lead to success in meeting legislated targets for the Washington energy code*

September 1, 2015

Prepared by:

Mark Frankel, Technical Director  
New Buildings Institute

Jim Edelson, Policy Director  
New Buildings Institute

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*“Meeting legislated targets”*

# WA Residential Code

## SECTION R406

### ADDITIONAL ENERGY EFFICIENCY REQUIREMENTS

**R406.1 Scope.** This section establishes options for additional criteria to be met for one- and two-family dwellings and townhouses, as defined in Section 101.2 of the *International Residential Code* to demonstrate compliance with this code.

**R406.2 Additional energy efficiency requirements (Mandatory).** Each dwelling unit in one- and two-family dwellings and townhouses, as defined in Section 101.2 of the *International Residential Code* shall comply with sufficient options from Table R406.2 so as to achieve the following minimum number of credits:

1. Small Dwelling Unit: ..... **0.5 points** Dwelling units less than 1500 square feet in conditioned floor area with less than 300 square feet of fenestration area. Additions to existing building that are less than 750 square feet of heated floor area.
2. Medium Dwelling Unit: ..... **1.5 points** All dwelling units that are not included in #1 or #3.
3. Large Dwelling Unit: ..... **2.5 points** Dwelling units exceeding 5000 square feet of conditioned floor area.

# Court Ruling

- **UNITED STATES COURT OF APPEALS**
  - **FOR THE NINTH CIRCUIT**
    - BUILDING INDUSTRY ASSOCIATION OF WASHINGTON; AIR AMERICA INC.;
    - BOA CONSTRUCTION CO.; COMPLETE DESIGN INC.; AIREFCO INC.; CVH INC.; ENTEK CORP.; FAMILY HOME INVESTMENTS CORP.; SADLER CONSTRUCTION INC.; TRACY CONSTRUCTION CO., No. 11-35207
      - *Plaintiffs-Appellants,*
      - ↑
      - *Defendant-Appellee,*
    - NW ENERGY COALITION; SIERRA CLUB; WASHINGTON ENVIRONMENTAL COUNCIL; NATURAL RESOURCES DEFENSE COUNCIL,
      - *Intervenor-Defendants-Appellees.* ]
    - Appeal from the United States District Court for the Western District of Washington
    - Robert J. Bryan, Senior District Judge, Presiding
      - Argued and Submitted
    - February 9, 2012—Seattle, Washington
      - Filed June 25, 2012

# Court Ruling

We therefore hold that the Washington Building Code satisfies the conditions Congress established for enforcement of state and local building codes consistent with federal energy law and we affirm the judgment of the district court in favor of the State.

# 2016 WA – Commercial Code

*<increased from six to nine>*

## SECTION C406

**ADDITIONAL EFFICIENCY PACKAGES C406.1 Requirements.** Buildings shall comply with no less than **two** of the following:

- More efficient HVAC performance in accordance with Section C406.2.
- Reduced lighting power density system in accordance with Section C406.3.
- Enhanced lighting controls in accordance with Section C406.4.
- On-site supply of renewable energy in accordance with Section C406.5.
- Reserved
- High-efficiency service water heating in accordance with Section C406.7.
- Enhanced envelope performance in accordance with Section C406.8.
- Reduced air infiltration in accordance with Section C406.9
- Increased lamp efficacy in dwelling units in accordance with Section C406.10.

• ***and as CE 230-16 (Louisville)***

# 2016 WA Commercial Code

- **C403.2.6.1 Dedicated Outdoor Air Systems (DOAS).** Outdoor air shall be provided to each zone by a Dedicated Outdoor Air System (DOAS) which delivers 100% outside air without requiring operation of the heating and cooling system fans for ventilation air delivery.

# OR Residential Code

## 2014 Energy Efficiency Additional Measures Requirements

Construction of New Residential Structure: Complete Sections A and B

---**Section A:** Envelope Enhancement Measure, Table N1101.1(2)  
(Select One)

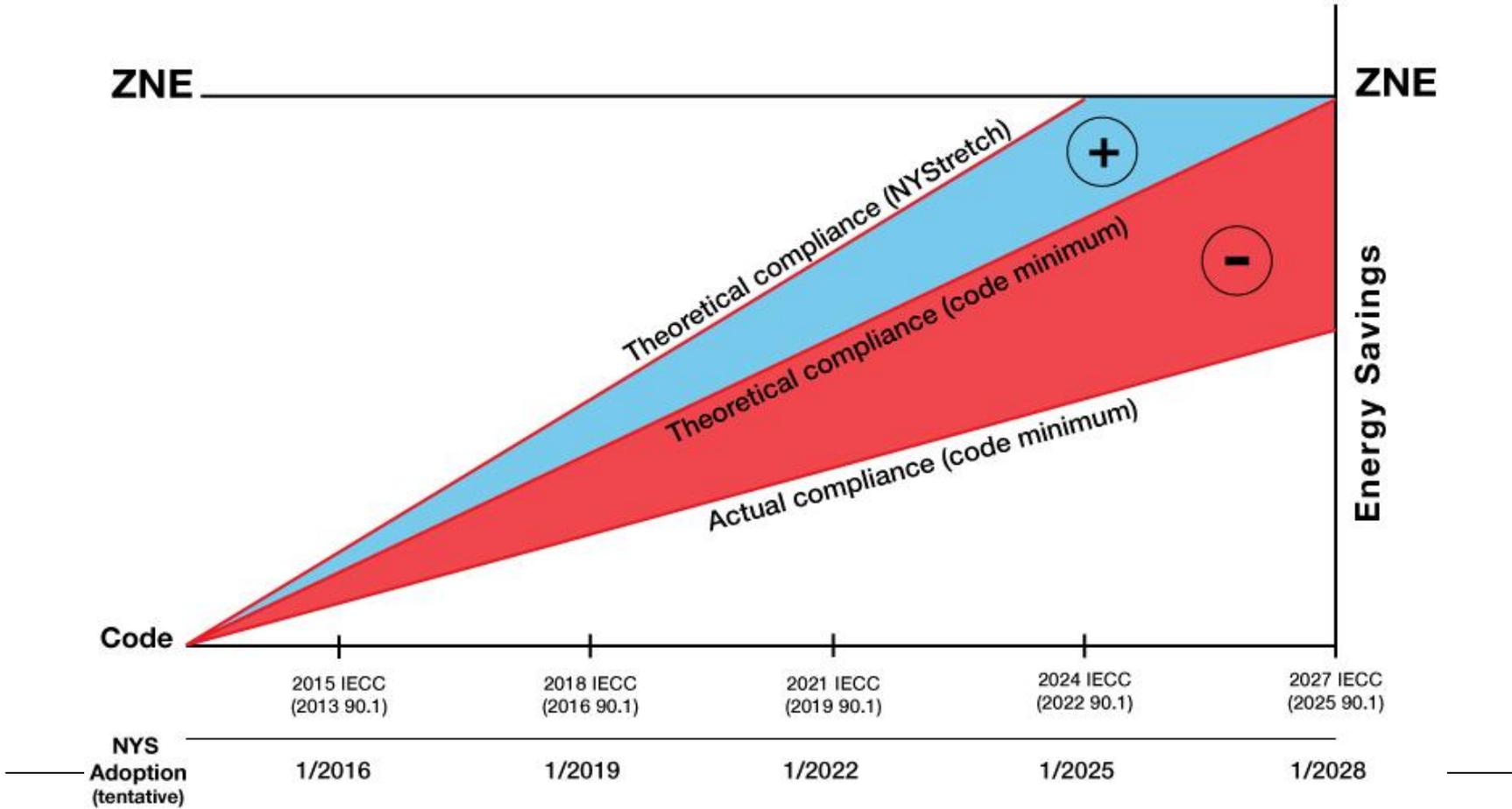
---**Section B:** Conservation Measure, Table N1101.1(2) (Select One)

1. High efficiency HVAC system options –

- a. Gas-fired furnace or boiler with 90% minimum AFUE (sealed combustion air ducted directly from outdoors if furnace or boiler is within conditioned space)
- b. Air-source heat pump 8.5 minimum HSPF, or
- c. Closed-loop ground source heat pump with 3.0 minimum COP

2. Ducts.....

# New York State



# 2016 NYStretch - Approaches

- **Expanding Packages (Commercial)**
- **ERI Scores + (Residential)**
- **Passive House compliance option**

# Market Dynamics

“The energy used for space cooling, heating, and ventilation accounts for more than thirty percent of the total energy operating cost for commercial buildings in the United States, and is the number one contributor to summer peak demand nationally.”

“EPRI estimates that replacing baseline unitary air conditioning and heat pump equipment with high efficiency equipment has a realistically achievable potential of approximately 16,000 GWh of energy savings in 2030, and ranks it as having the fifth highest realistic achievable energy savings potential of major end uses through 2030.”

***CONSORTIUM FOR ENERGY EFFICIENCY, 2016***

***Energy-Efficient HVAC Systems for Commercial Buildings: Unitary Systems, Heat Pumps, Furnaces, Boilers, VRF Systems, Chillers, and Geothermal Heat Pumps for Energy-Efficient Buildings (Navigant Research 3Q 2015)***

- Ductless cooling systems have historically been utilized most widely in Europe and Asia Pacific, where they are typically the preferred cooling systems for most commercial applications.
- In N America, ductless systems are projected to grow at a compound annual growth rate of more than 14 percent between 2013 and 2020
  - Estimated to be more than \$9 billion by 2020



## Top 12 in 2014



Ranking	Country	Trend	Market Value*	Market growth** (%)	Hot products
1	China		34,290	+ 4%	Ductless, VRF, Chillers
2	USA		13,677	+ 8%	US Ducted, VRF, Chillers
3	Japan		10,959	0%	None
4	Brazil		2,883	+ 17%	Ductless, VRF, Chillers
5	S. Korea		2,227	+ 1%	Ductless, VRF
6	India		2,199	+ 14%	Ductless, VRF, AHU
7	Italy		1,349	+ 2%	None
8	Saudi Arabia		1,316	+ 10%	Ductless, Ducted, VRF
9	Australia		1,292	+ 3%	Portables
10	Russia		1,273	- 1%	None
11	Germany		1,106	+ 5%	Ductless, VRF, Chillers
12	UK		1,066	+ 7%	Ductless, VRF, AHUs

\* In US\$ million for 2014

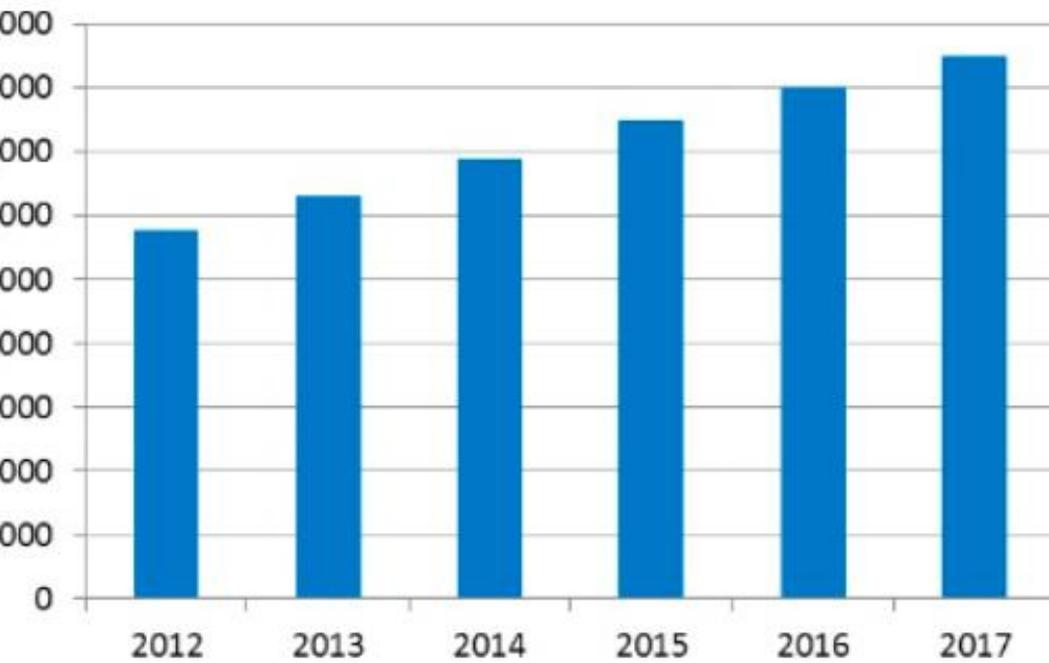
\*\* CAGR from 2014 to 2017

Excellence in Market Intelligence

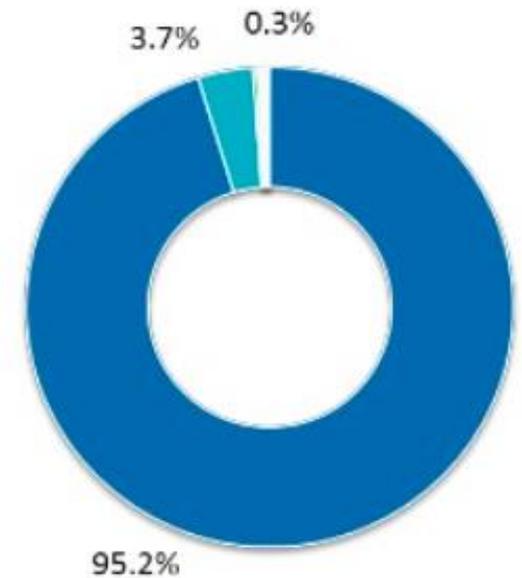
7



**World Market for US Ducted Splits from 2012 to 2017 in units (number of pieces)**



**Top 10 countries in the world market for US Ducted Splits in 2014 in value**



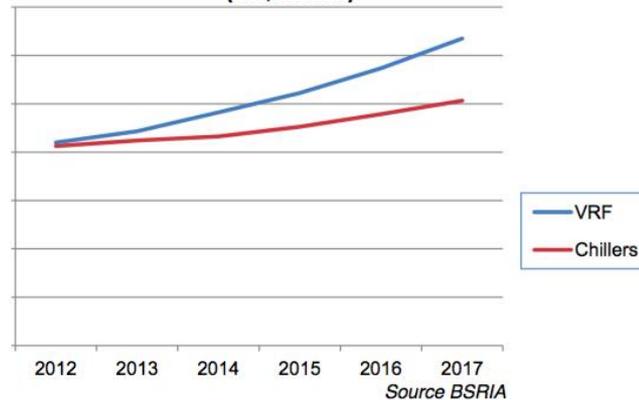
The US Ducted Split is almost exclusively a North American residential market.



## VRF Systems threatening BACS market



Global Sales - VRF and Chillers 2012 - 2017  
(US \$ Million)

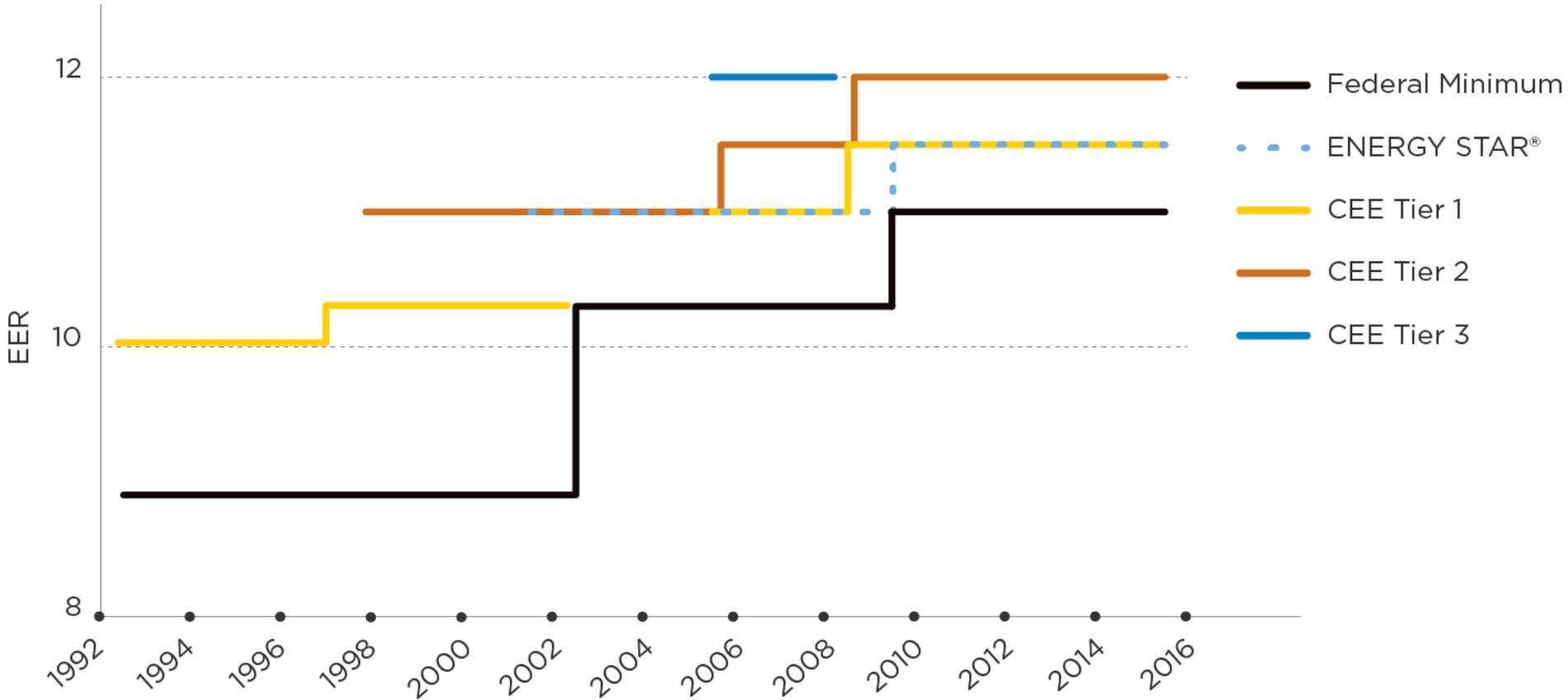


- VRF solutions gaining market share - gap continues to widen
- Majority of leading HVAC suppliers include VRF solutions in their portfolios
- VRF solutions provide more localised control
- VRF control capability eating away at BACS system functionality & market

**Excellence in Market Intelligence**



Figure 4. HECAC tiers over time: EER for unitary air conditioners  $\geq 65,000$  and  $<135,000$  Btu/h  
**CONSORTIUM FOR ENERGY EFFICIENCY, 2016**





GETTING TO  
**zero**  
NATIONAL FORUM 2016

Save the Date

October 12-14, 2016 | Denver, CO

Bertschi School Science Wing Seattle, WA | Photo: KMD Architects

**nbi** new buildings  
institute



# Thank You!

Ralph DiNola

CEO, NBI

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343 Second Street

David and Lucille Packard Foundation Building  
Courtesy: EHDD