Energy Codes and Net ZeroBuildings

Jim Edelson
Director – Codes and Policy
New Buildings Institute

Hood River Middle School
Photo:Michael Mathers

New Buildings Institute (NBI)

- Nation-wide non-profit
- Board of Directors represent leaders in energy efficiency and green building
- Strategic relationships with leading organizations including AIA, USGBC, NEEA, CPUC etc
- Staff of leading building science technical experts and research managers
- Funding from progressive utilities, foundations and research projects

Agenda

1. ZNE as a Policy Target
2. Can be measured with zEPI
3. Three Challenges:
   a)MaxTech
   b)Preemption
   c) Certificate of Occupancy
4. Reach Codes and Utility Programs

Why Whole-Building, Absolute Energy Targets?

(credit to Mike Leach, PNNL, ACEEE Summer Study, 2012)

Definition: target that represents total, as-operated energy use

- Clear goals without room for interpretation
  - No interpretation of codes or standards or assumptions of typical design and use are required
- Directly measureable
  - Encourages and facilitates goal verification
  - Enables contractual inclusion of energy goals
- Capture whole-building energy performance
  - Encourages design team to carefully consider aspects of building performance that may be overlooked by codes or standards
- Place focus on low-energy design
  - Project resources are applied to improving low-energy design
  - Allows for design flexibility and encourages innovative, cost effective, integrated design strategies

Setting Bold Targets

California Code Cycles to ZNE

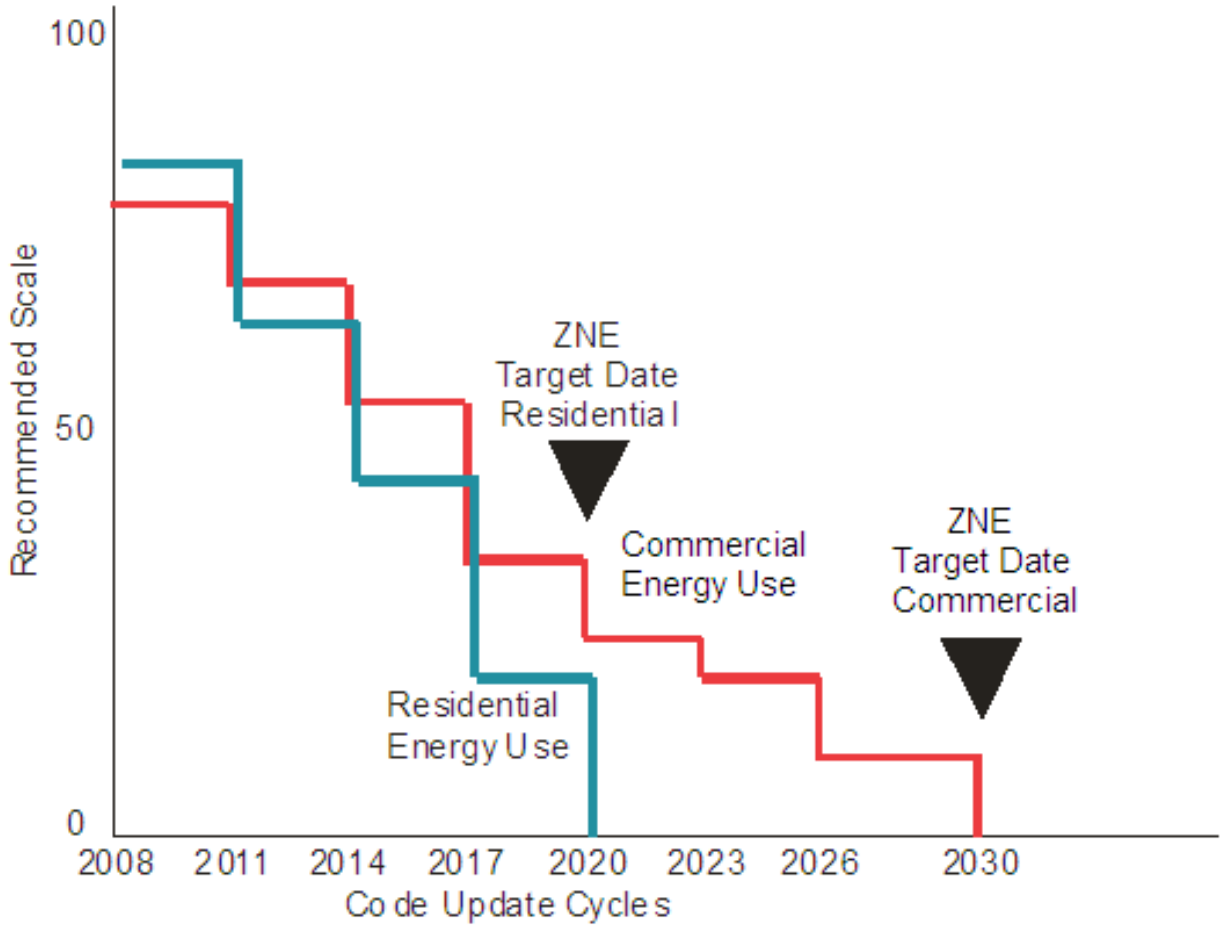
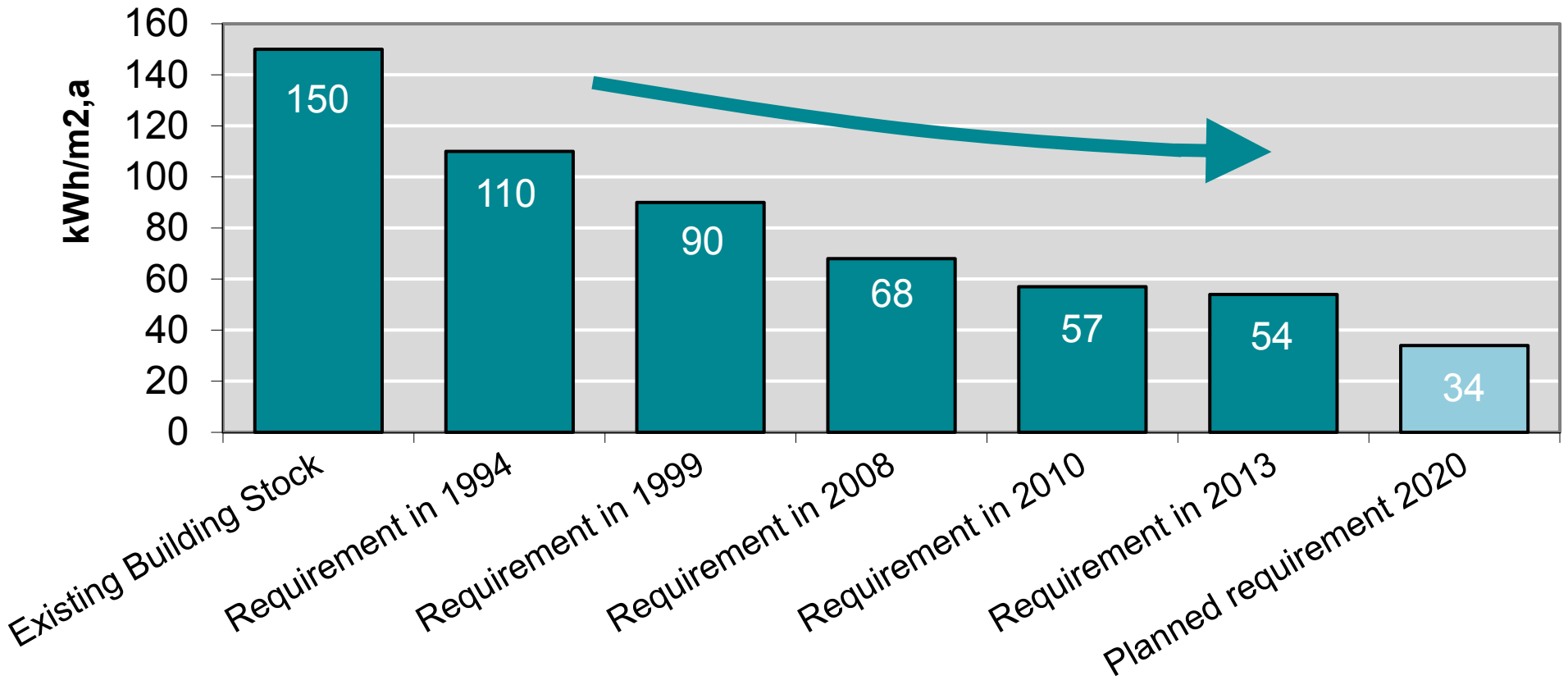


Figure 2. Code Cycles to ZNE, Source: SCE & AEC, 2009

Upper Austria Energy performance indicators as the basis for building energy codes (ex.: 1family homes)



WASHINGTON

BRITISH
COLUMBIA

CALIFORNIA

OREGON

PACIFIC COAST COLLABORATIVE

"Transform the market for energy efficiency and lead the way to "net-zero" buildings"

ZNE Building *(DOE proposed)*

Actual Annual Energy Use =

Actual Annual Energy Production

2. Why zEPI?

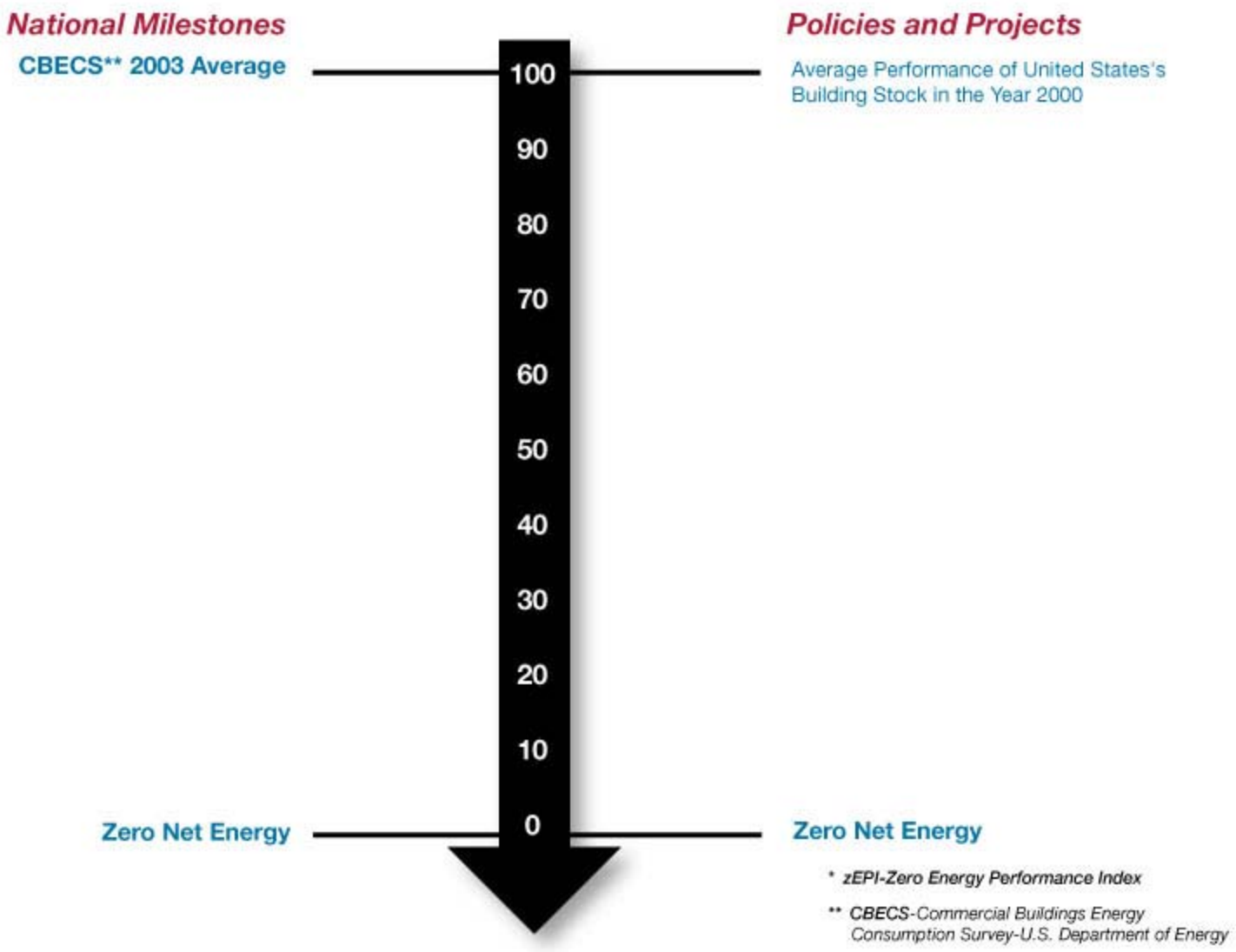
Different individual buildings, energy code baselines, and even building portfolios can all be compared on the same scale.

Charles Eley

2015 IgCC Definition

- **ZERO ENERGY PERFORMANCE INDEX (zEPI).** A scalar representing the ratio of the energy performance of a proposed design or an existing building compared to the mean energy performance of the building stock from the benchmark year of 2000

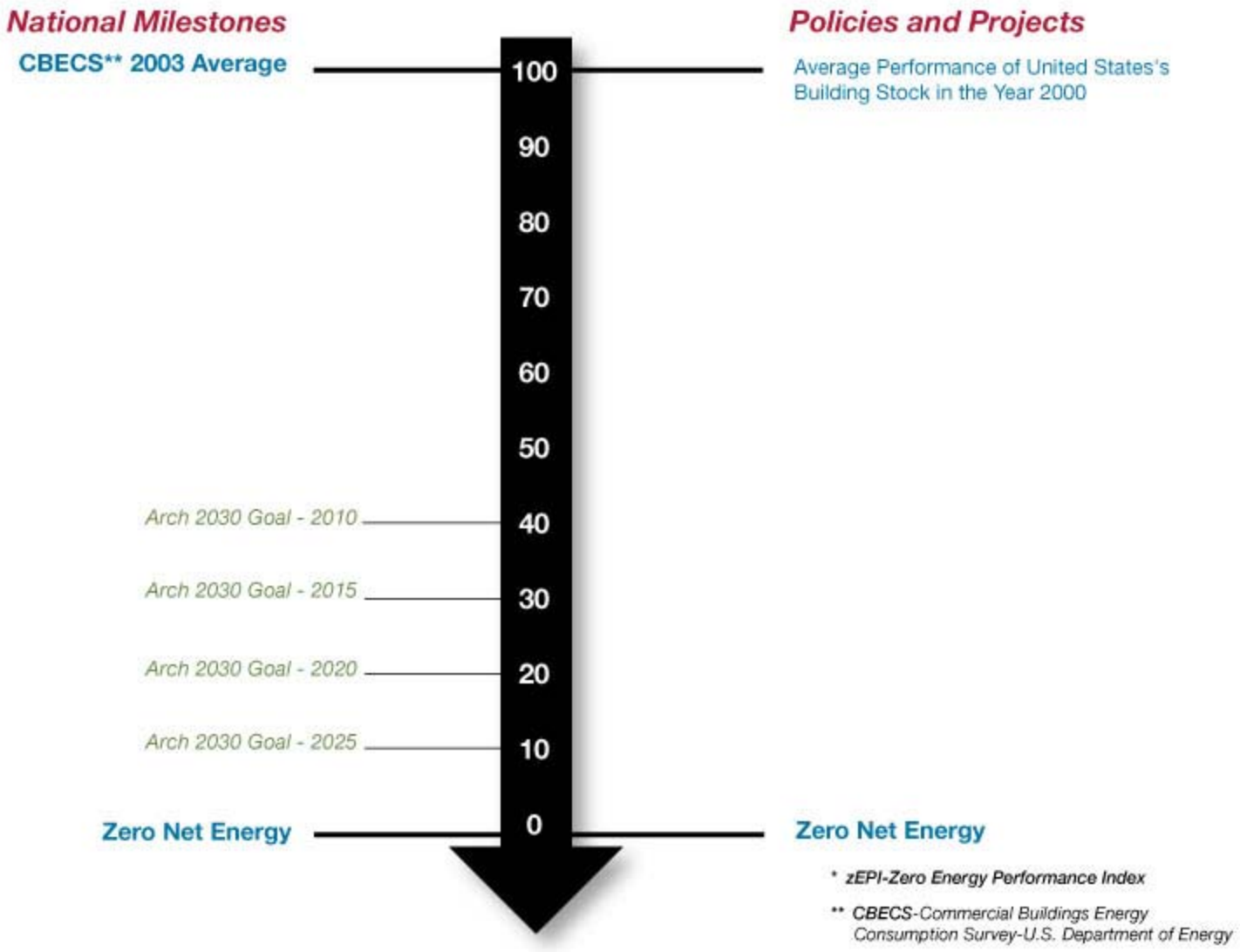
zEPI* Scale to ZNE



* *zEPI-Zero Energy Performance Index*

** *CBECS-Commercial Buildings Energy Consumption Survey-U.S. Department of Energy*

zEPI* Scale to ZNE



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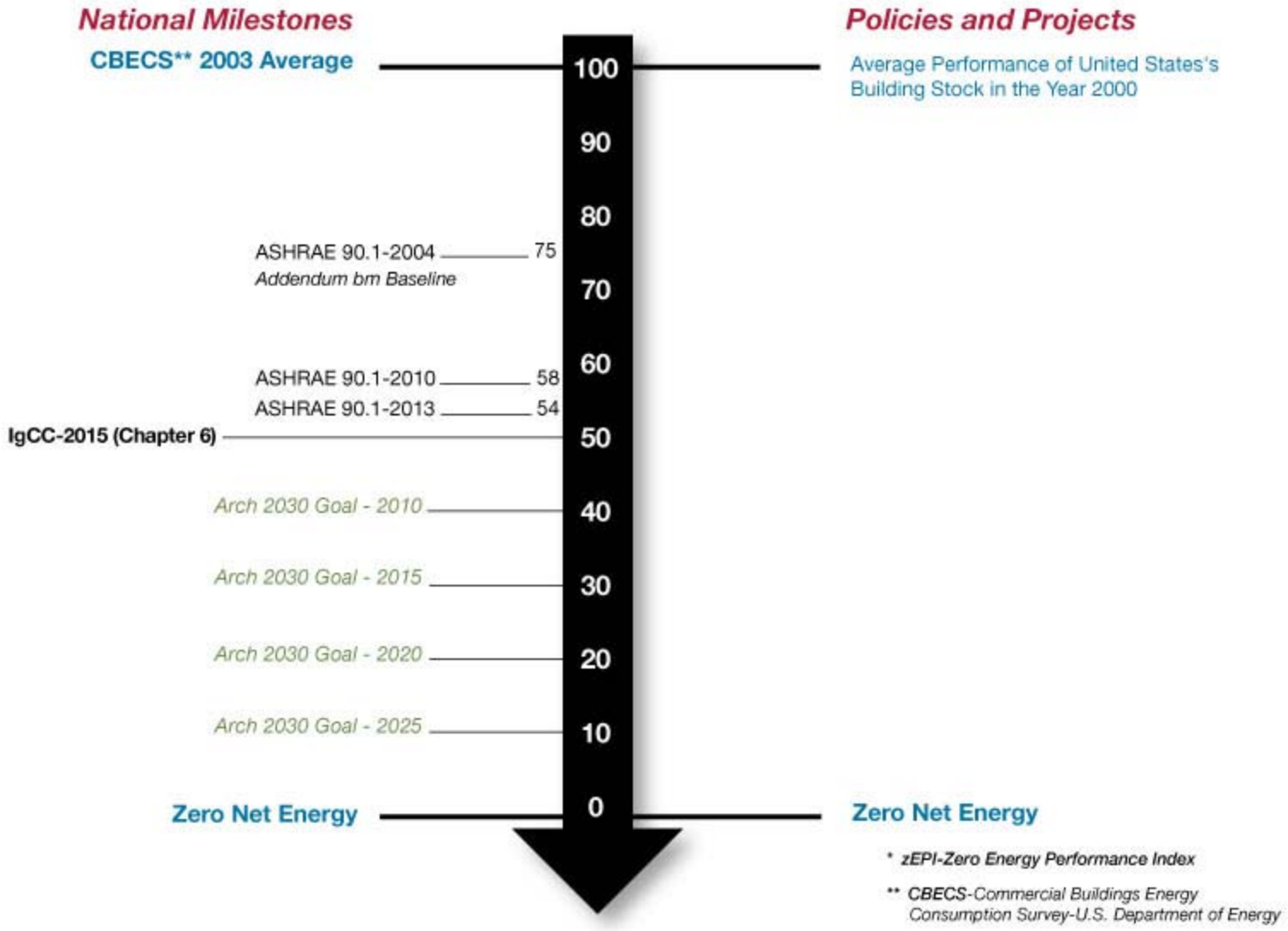

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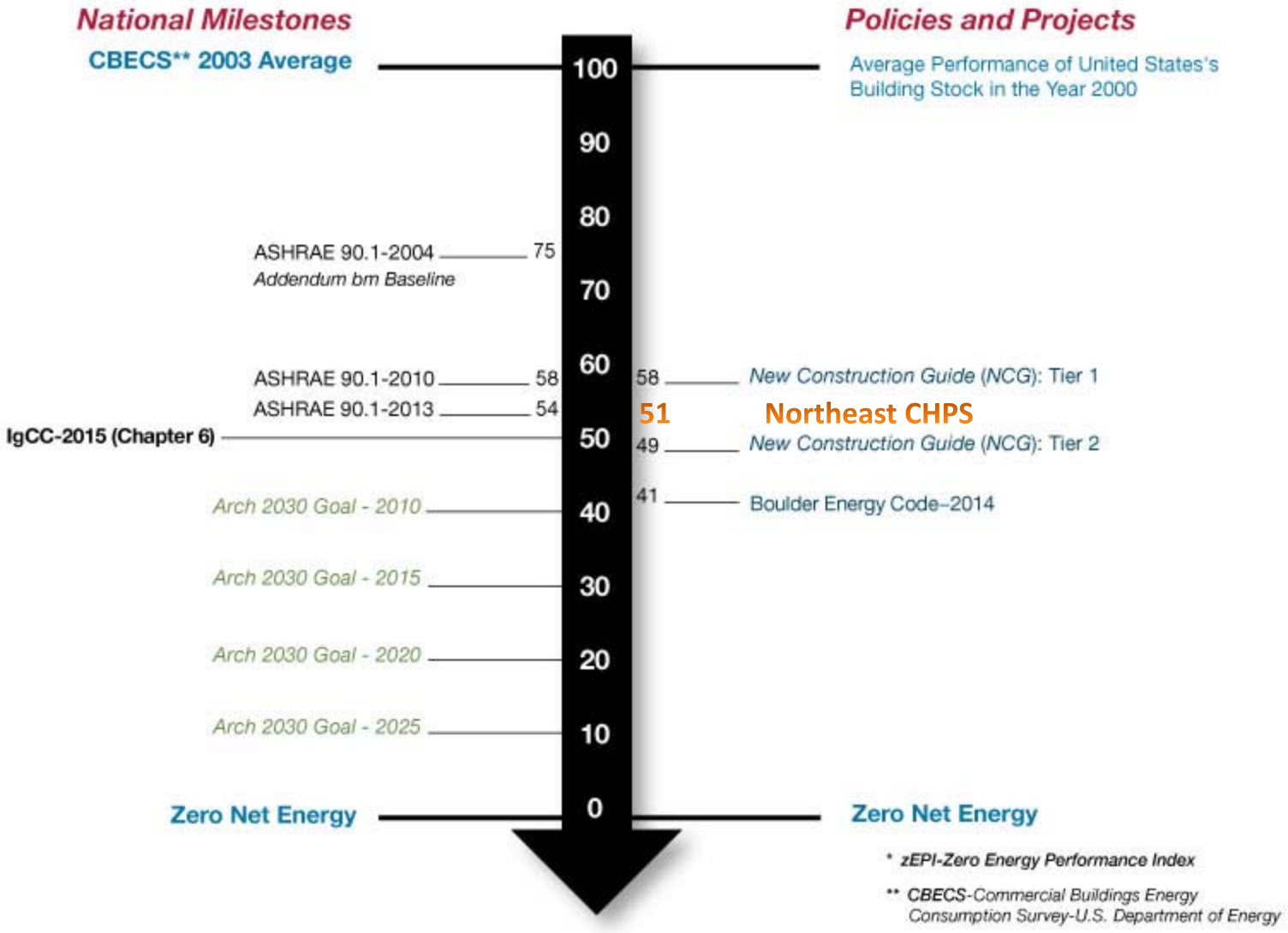
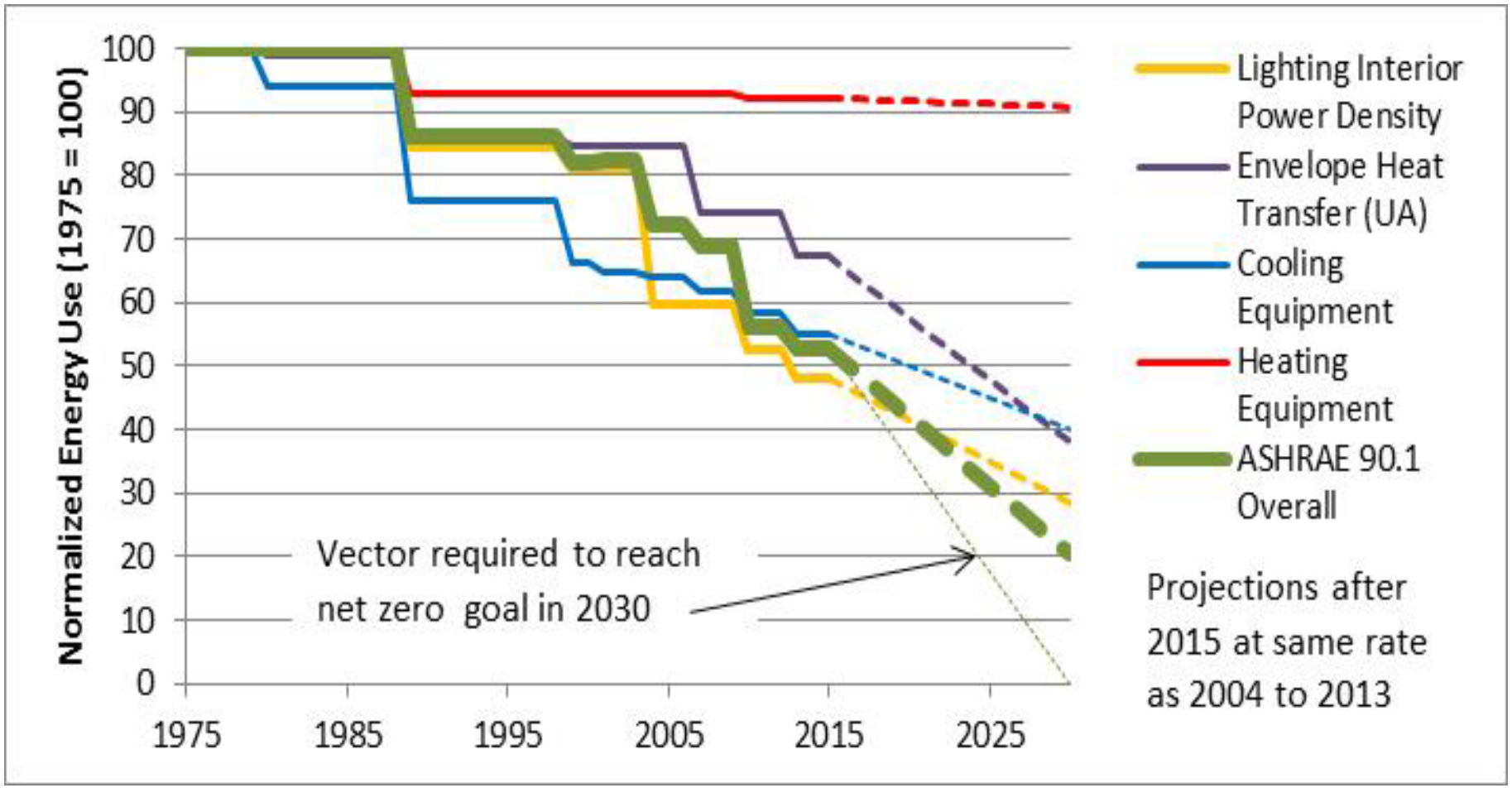


3. Challenges to ZNE as a Target ?

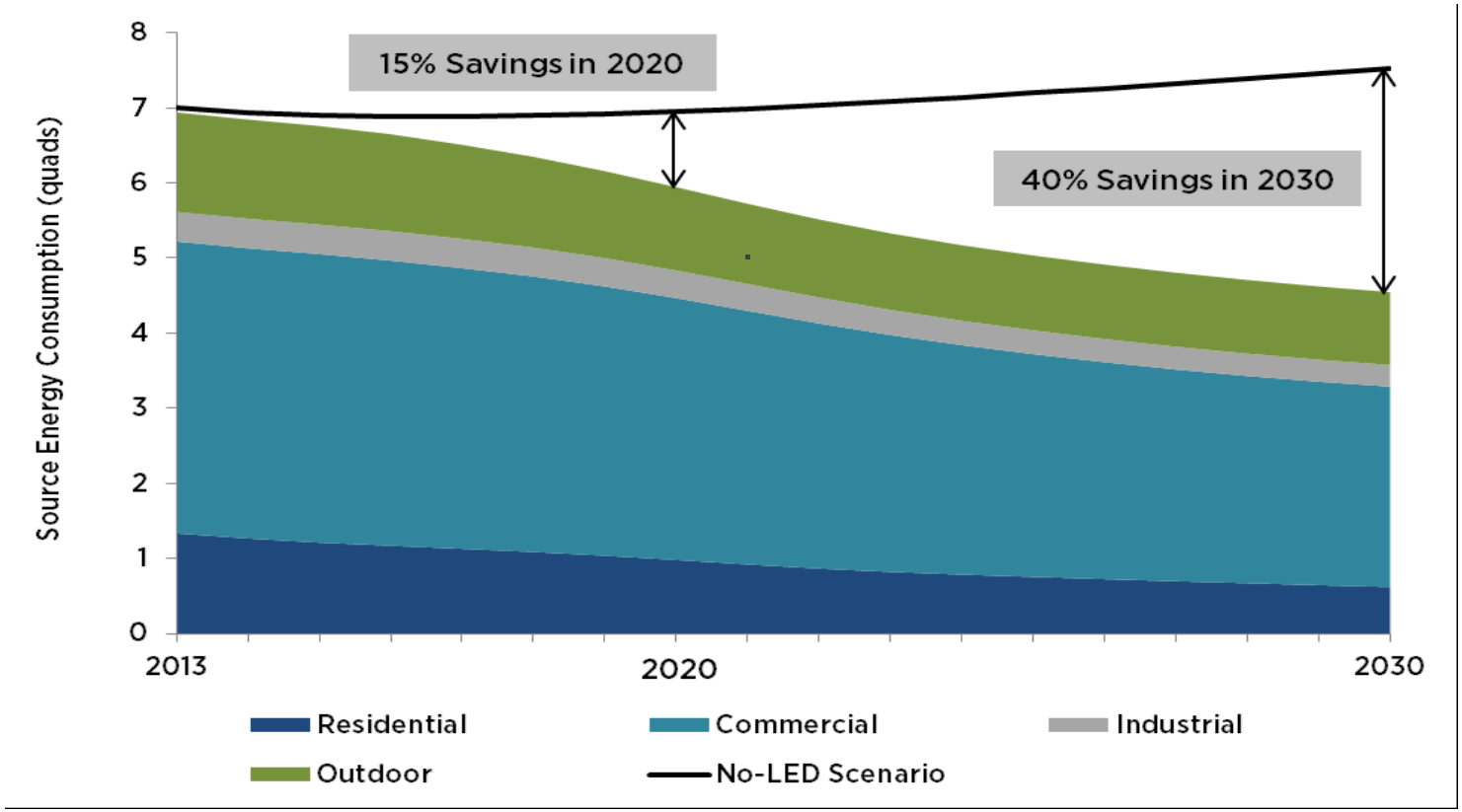
- MaxTech
- Federal Preemption
- Actual Energy Use vs Design

End Use Efficiency Progression



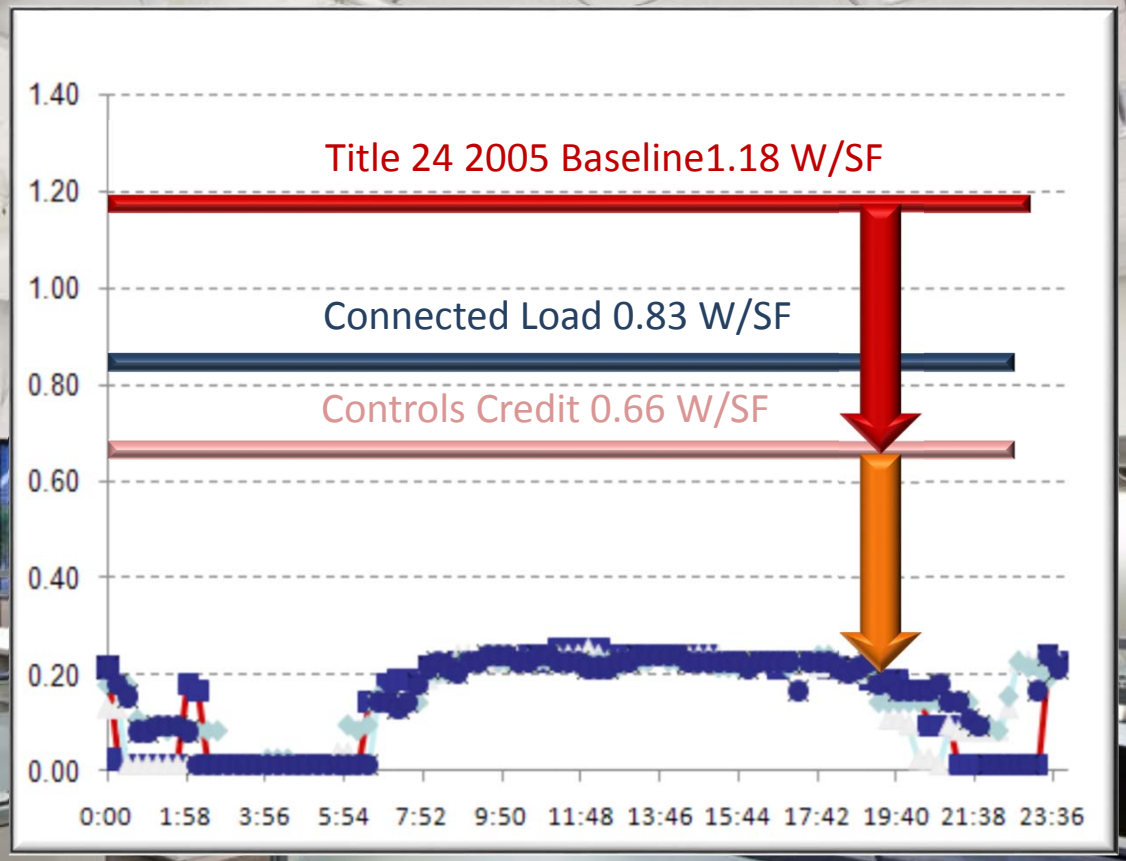
DOE – Lighting savings to 2030

Energy Savings Forecast of
Solid-State Lighting in General
Illumination Applications
August, 2014



Office of the Future Program

- Single-Fixture Task-ambient (task light provides ambient)
- All building lighting on occupancy sensors
- Private offices 50% auto-on with occupancy sensors, all lights auto-off



Courtesy of Glumac

The ZNE Equation

Annual Energy Use = Annual Energy Production

Solar Costs Will Fall Another 40% In 2 Years. Here's Why.

January 29th, 2015 by **Giles Parkinson**

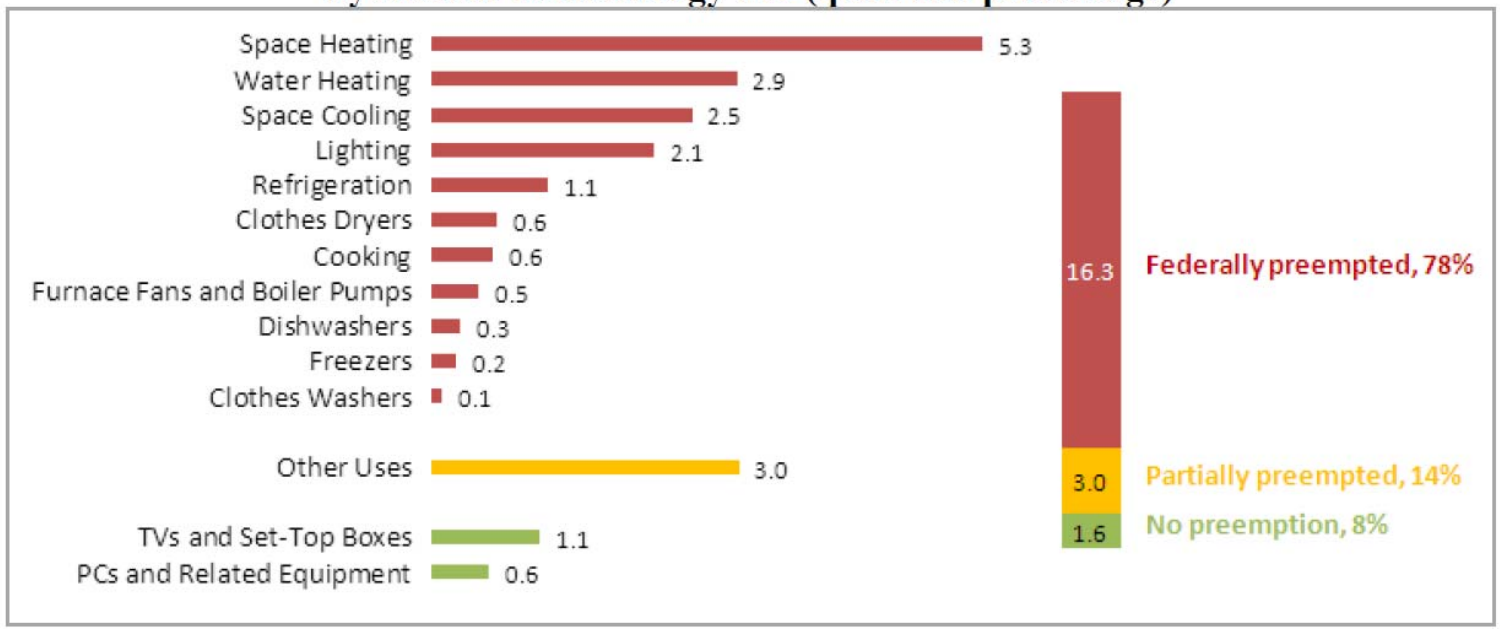
Pre-emption

USC Title 42 - Section 6316(b)(2)(A)

- "A standard prescribed or established under section 6313(a) of this title shall . . . **supersede any State or local regulation** concerning the energy efficiency or energy use of a product for which a standard is prescribed or established pursuant to such section."

Federal Residential Pre-emption

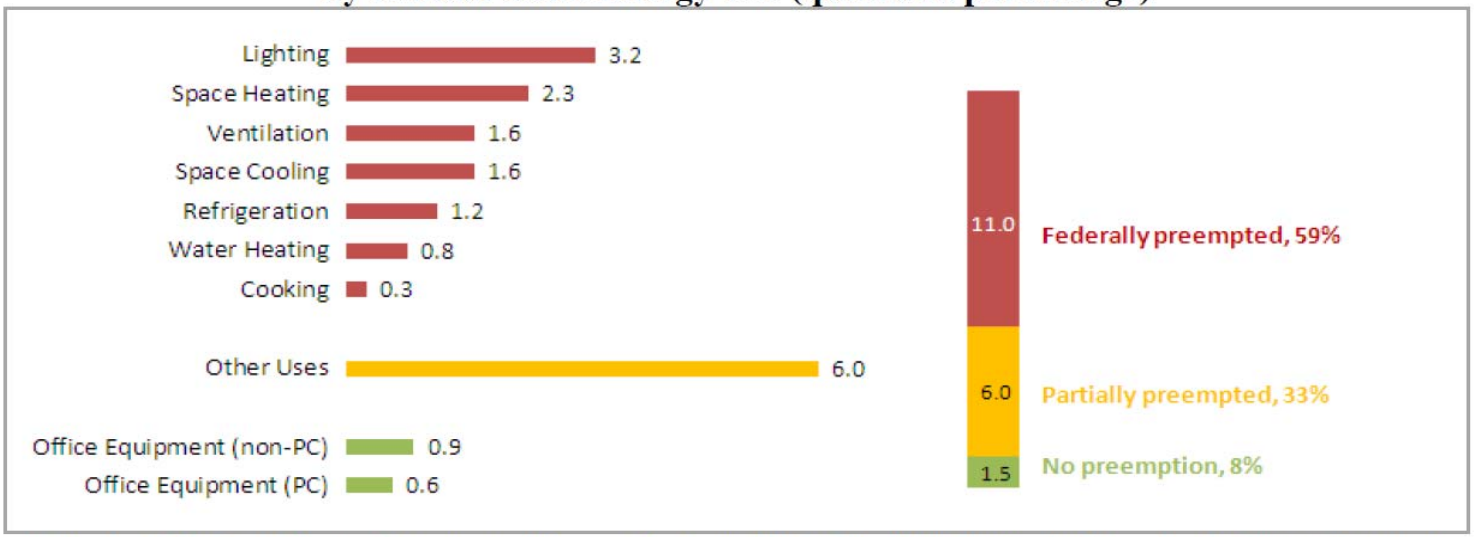
Figure 1. U.S. Residential Equipment Stock, Covered and Uncovered by DOE, by Annual Total Energy Use (quad and percentage)



Source: Authors' analysis of the *Annual Energy Outlook 2011* (EIA 2011a). Quad values are for 2012. The major equipment types within the "Federally preempted" category are all preempted, but there may be some smaller loads that are not covered by DOE standards. For example, the lighting category includes some product categories that are not currently covered by DOE standards, such as multifaceted reflector lamps. The "Other Uses" category includes all products not included in the other categories, such as audio equipment, game consoles, vacuum cleaners, DVD players, coffee makers, etc.).

Federal Commercial Pre-emption

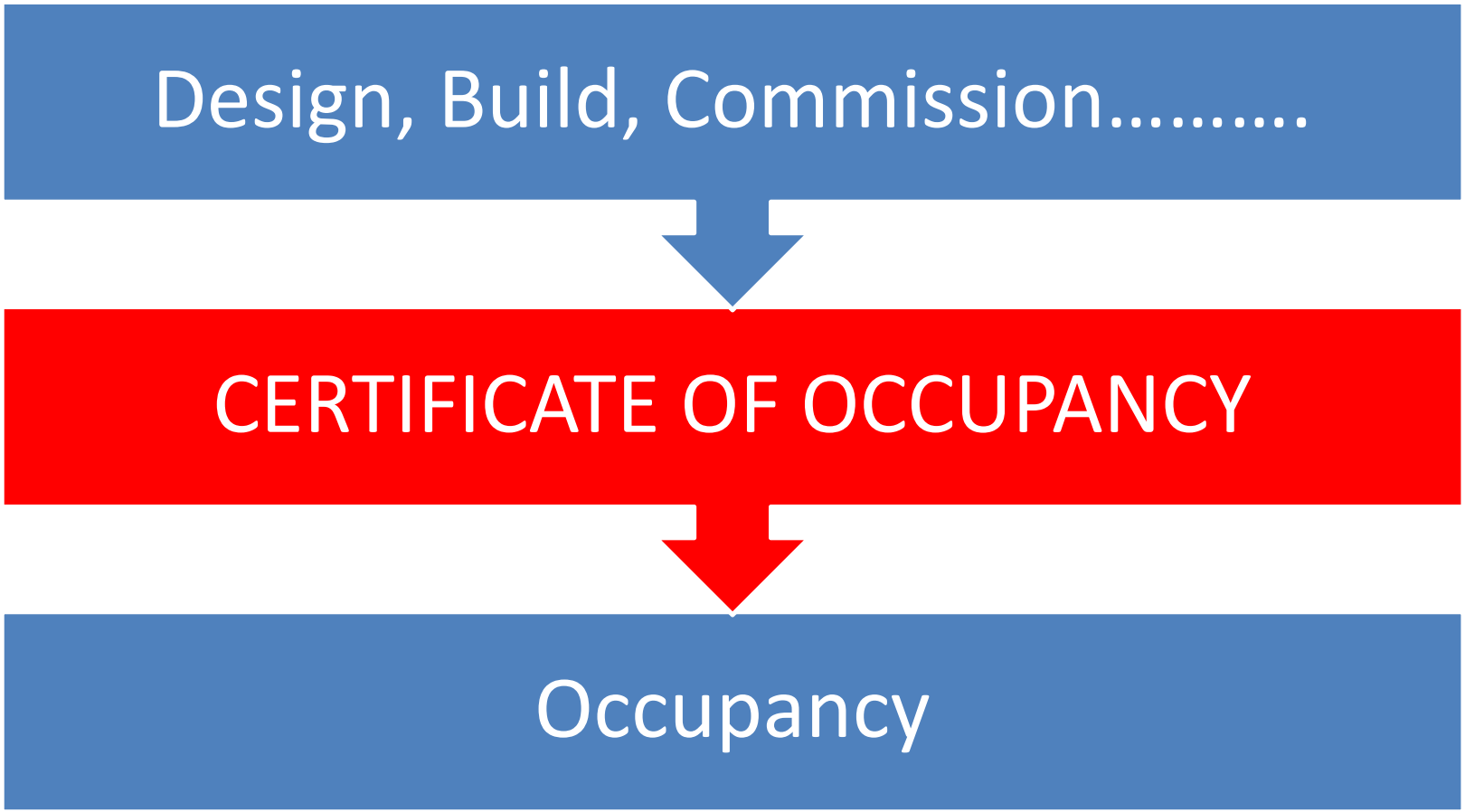
Figure 2. U.S. Commercial Equipment Stock, Covered and Uncovered by DOE, by Annual Total Energy Use (quad and percentage)



Source: Authors' analysis of the *Annual Energy Outlook 2011* (EIA 2011a). Quad values are for 2012. The major equipment types within the "Federally preempted" category are all preempted, but there may be some smaller loads that are not specifically covered by DOE standards. The lighting category includes some product categories that are not currently covered by DOE standards (e.g., MR lamps). The "Other Uses" category includes equipment such as service station equipment, ATMs, telecommunications equipment, medical equipment, pumps, emergency generators, combined heat and power in commercial buildings, and manufacturing performed in commercial buildings, plus residual fuel oil, liquefied petroleum gases, coal, motor gasoline, and kerosene.

U.S. Congress

The Red Line for Energy Codes



Basic Mechanism of Code: Regulating Design Components

Redding School for the Arts, CA
Courtesy: Trilogy Architecture & Steve Whittaker Photography

OUTCOME-BASED PATH 2015 IgCC:

A simple division and multiplication

- zEPI = 100 (EUI_a / EUI_r)

Where:

- EUI_a = the Actual Annual Energy Use Index for the *building* and *building site*
- EUI_r = the Reference Annual Energy Use Index for the *building* use and occupancy in Table 612.1 *(i.e. a table of CBECS values for 9 building types across 14 climate zones)*

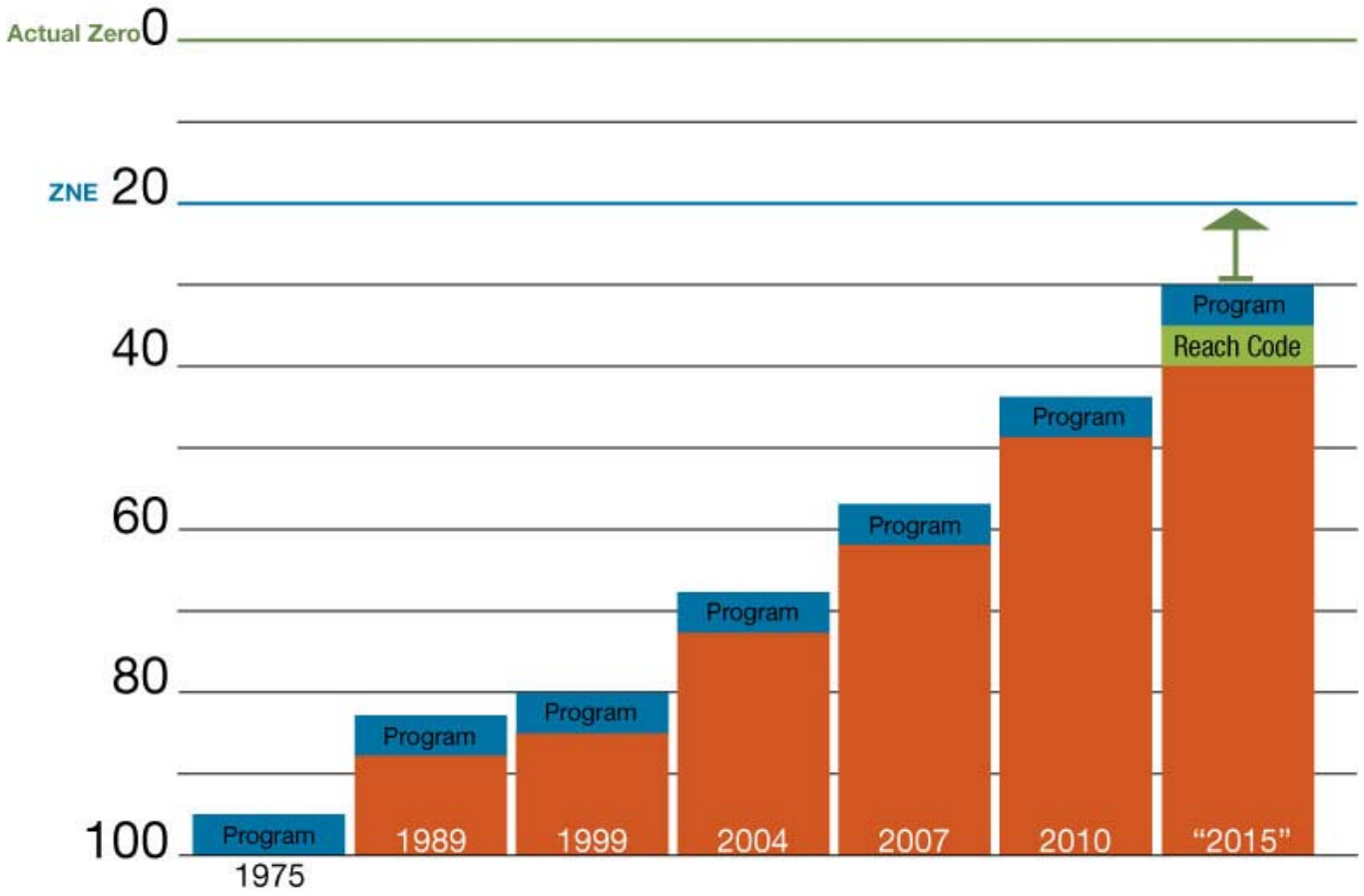
→ The zEPI must be 51 or lower – or 49% below CBECS-2003.

4. Stretch (or Reach) Energy Codes

- Results in more energy savings than a base energy code
- Mandatory or voluntary mechanisms
  - Adopted by cities
  - Used for public buildings
  - Tax or other incentive programs
- Signals where future codes are going
- Can work in tandem with utility programs

  - regulatory, timing, and savings

CODES AND POLICY – Utilities and Codes



Design of Programs Around "Reach (next-cycle) Codes"

- Involvement in development of reach codes
- Once reach code is established, utility can support:
  - Incentives to projects for meeting reach codes till they become the baseline code
    - Reward early adopters who set the stage
    - Helps through transitional stages of a higher performance codes
    - Good market transformation strategy

CREDIT TO NATIONAL GRID

Keys to Successful Reach Codes

- Political Will
- Utility Involvement
- Content and Flexibility
- Political Will

Summary:
Tools for Getting to ZNE Codes

- ZNE Policy Precedents
- Measure-level and systems technology acceleration
- Rapid decrease in costs of renewables
- Track progress to ZNE on zEPI
- Utility Program Alignment to ZNE Goals
- Reach Codes

Two Americas in 2030?