A spiral-bound notebook with a brown cover and a light beige, textured fabric-like surface. The spiral binding is on the left side. The text is centered on the page.

# ZERO

Net Energy  
Buildings

Martha Brook, P.E.

High Performance Buildings &  
Standards Development Office  
California Energy Commission

# Presentation Topics

Why ZNE in California?

ZNE Standards

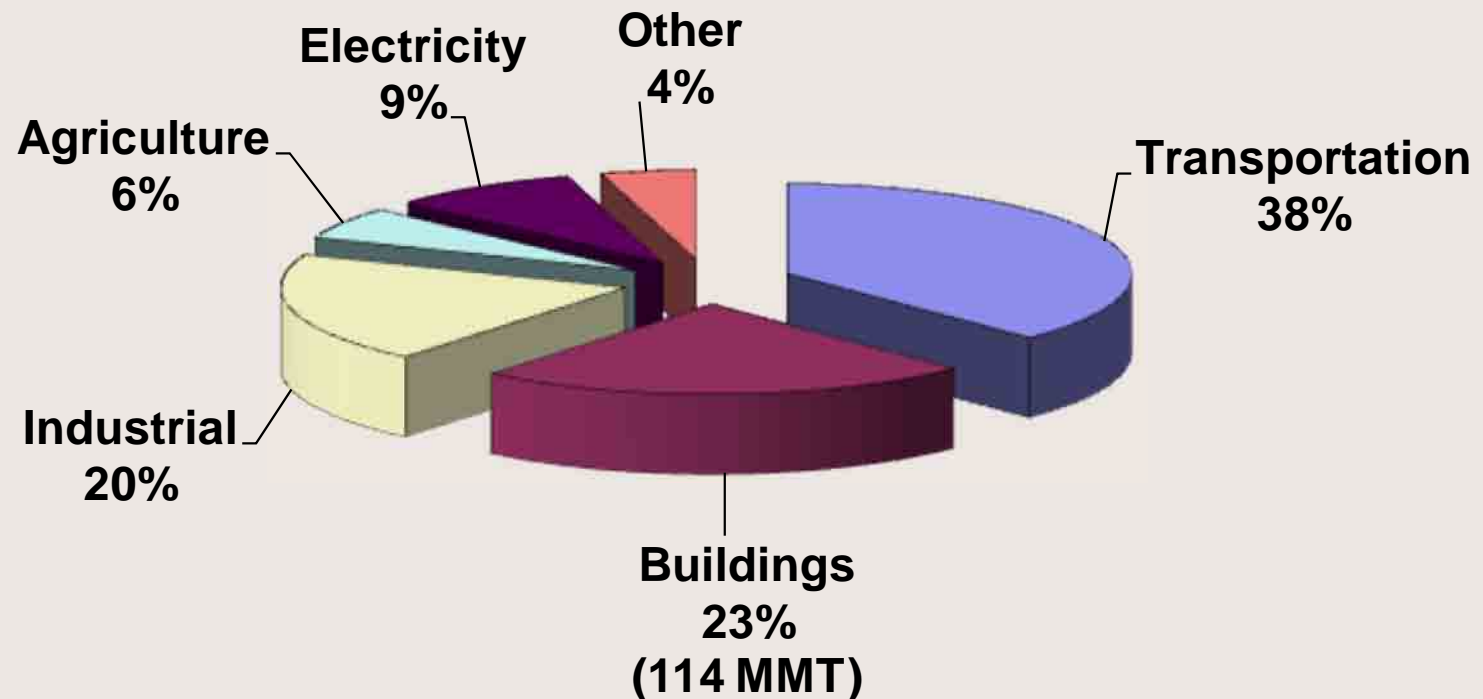
- Path to zero
- Scope & reach of future Standards
- Performance Ratings
- Compliance Rules & Software Architecture

Concept for an Energy Analysis Collaborative

# Why ZNE in California?

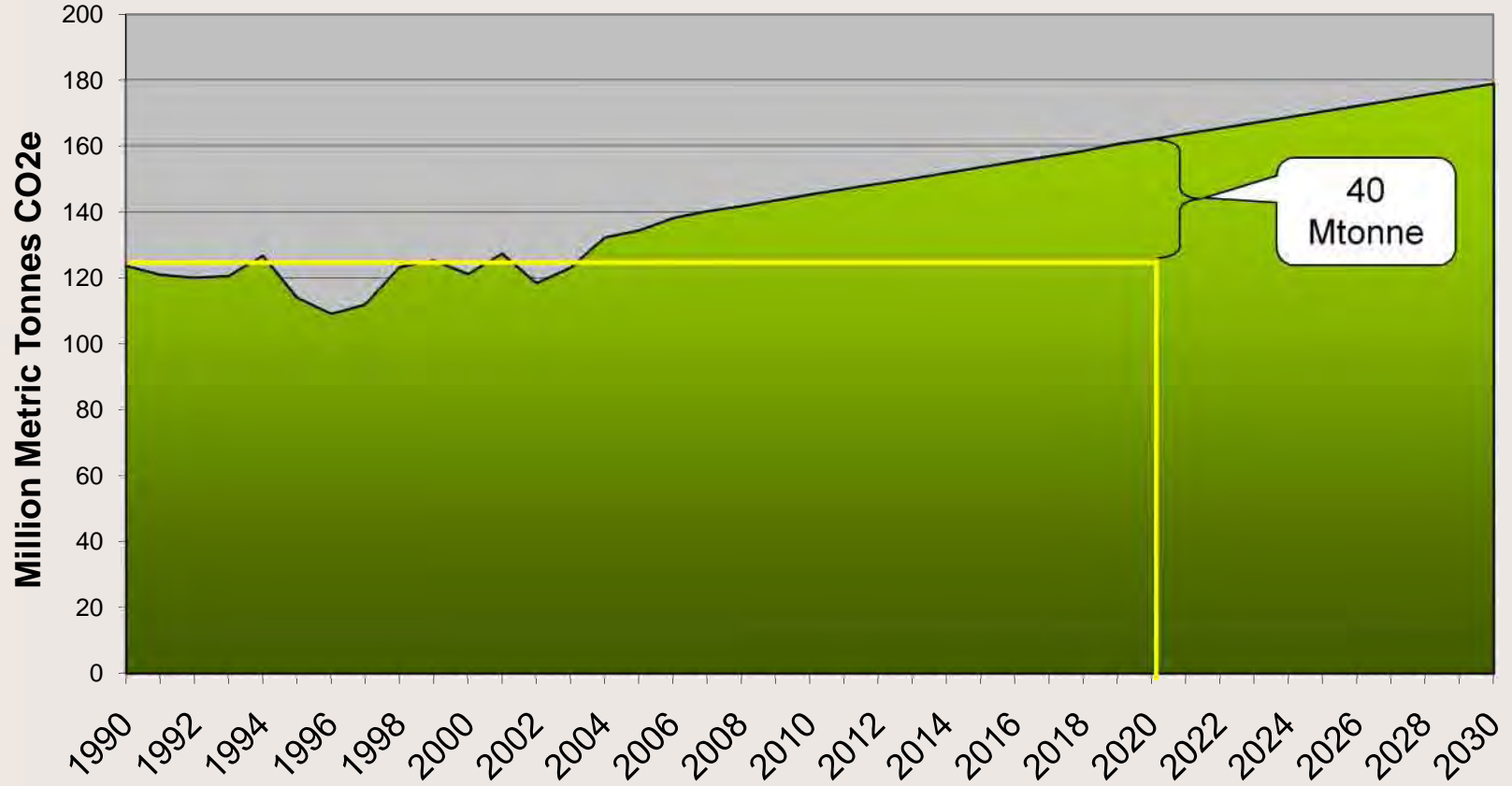
## CA GHG Emissions

484 MMT CO<sub>2</sub>e (2004)



# Why ZNE in California?

**Building Greenhouse Gas Emissions**  
1990-2004 from the CARB GHG Emissions Inventory  
future estimates based on CEC Electricity Demand Forecast



# ZNE Standards



## Expansion of scope - for both Appliance & Building Efficiency Standards

- Consumer Electronics, General Lighting
- Process Loads (e.g. Data Centers, Commercial Kitchens, Laboratories, Refrigeration Systems)

## Code requirements earlier in the design process

- Subdivision plans impact house orientation and solar access
- Conceptual design phase of commercial bldg. defines orientation, mass, glazing, daylighting

# ZNE Standards

## Reach Standards for Title 24

Voluntary Standards for additional energy efficiency & on-site renewable energy generation

Base Std.

Tier 1: 15% better

Tier 2: 30% better



# ZNE Standards

## Reach Standard will provide:

- List of measures for migration to mandatory Standards
- Demonstration of "new" technologies

## Reach Standard will become:

- Voluntary efficiency program targets; Eligibility criteria for solar incentives programs; Energy basis of regional green building codes
- Energy Chapter of the California Green Building Standards (Title 24, Part 11)

# ZNE Standards

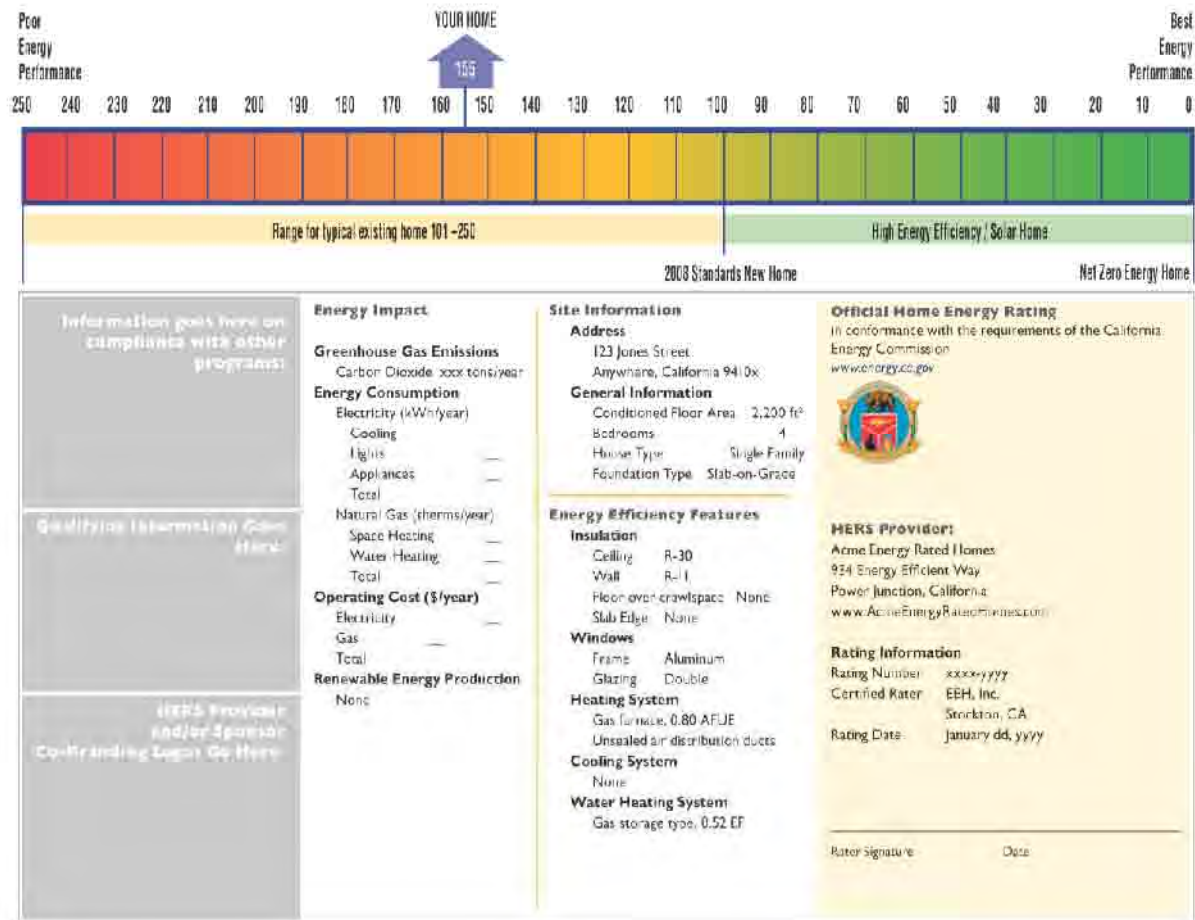
As Standards advance, field performance verification will play a bigger role

- Measures with poor compliance or poor installed performance need more commissioning
- "New" technologies will need field performance testing
  - e.g. daylighting controls; radiant heating & cooling
- How do we commission performance Standards?
  - Paper compliance vs. field performance



# ZNE Rating Scale

## California Home Energy Rating Certificate



# What does Title 24 look like in 2020?

**CERTIFICATE OF COMPLIANCE: RESIDENTIAL** (Page 1 of 5) **CT-1R**

Project Title: \_\_\_\_\_ Date: \_\_\_\_\_ Building Permit #: \_\_\_\_\_  
 Project Address: \_\_\_\_\_  
 Documentation Author: \_\_\_\_\_ Designer: \_\_\_\_\_ Plan Check / Date: \_\_\_\_\_  
 Compliance Method (Prescriptive): \_\_\_\_\_ Climate Zone: \_\_\_\_\_ Field Check / Date: \_\_\_\_\_  
 Enforcement Agency Use Only

Alternative Component Method: (check one)  C  D  Alternative  
 Package C and Package D require PTRS rates field verification and/or field testing (see CT-1R, page 1)  
 For Package D Alternative see Table 151-C Footnotes 7-14

**GENERAL INFORMATION**

Total Conditioned Floor Area: \_\_\_\_\_ ft<sup>2</sup>  
 Average Ceiling Height: \_\_\_\_\_ ft  
 Maximum Allowed Window and Glass Door Products Per Table 151-B or 151-C: \_\_\_\_\_ (5% of floor area) ft<sup>2</sup>  
 Maximum Allowed Total Glass Products Per Table 151-B or 151-C: \_\_\_\_\_ (20% of floor area) ft<sup>2</sup>

Building Type: (check one) Single Family \_\_\_\_\_ Multifamily \_\_\_\_\_ Attached \_\_\_\_\_ Detached \_\_\_\_\_  
 (If adding fenestration for Additional and Alternative Applications, see Section 8.3.2)

Number of Stories: \_\_\_\_\_ of Dwelling Units: \_\_\_\_\_  
 Floor Construction Type: \_\_\_\_\_ Slab Raised Floor (circle one or both)  
 Front Orientation: \_\_\_\_\_ (North, East, West) All Orientations (input from \_\_\_\_\_ in degrees from True North and circle one).

RADIANT BARRIER \_\_\_\_\_ (climate zones 2, 4, 8-15)

**OPAQUE SURFACES INCLUDING OPAQUE DOORS**

Component Type (Wall, Roof, Floor, Slab Edge, Doors)	Frame Type	Cavity	Contiguous	U-factor (for wood, metal frame and mass assemblies) <sup>1)</sup>	Joint Appendix IV Reference	Roof Radial Barrier Installed Yes or No	Location Comments (e.g., garage, typical, etc.)

**ENERGY BUDGET**

1) see Joint Appendix IV in Section IV.7, IV.1 and IV.4 which is the basis for the U-factor criterion. U-factors can not exceed prescriptive value to show equivalence to R-values.

# ZNE: Requirements for Renewables?

## Performance Budget Metric

- Energy Usage vs. Emission Generation

## Solar as solution to orientation issue?

- Energy budget based on no west facing glass
- Allow excess energy above budget to be met w/ solar

# ZNE Modeling Rules

## Modeling

- Enable innovation
- Credit best practices

## Computer Processable Performance Rules

- Create, modify & document using controlled vocabulary and logical operators
- Share data dictionary and rules language with all stakeholders
- ZNE technology advocates can build & test new rules

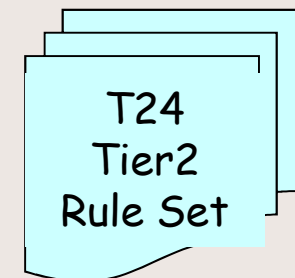
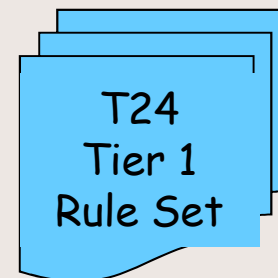
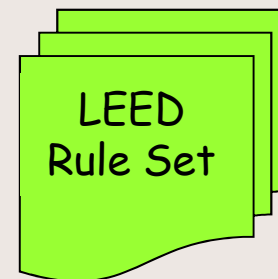


Title 24  
Rule Set

# ZNE Modeling Rules

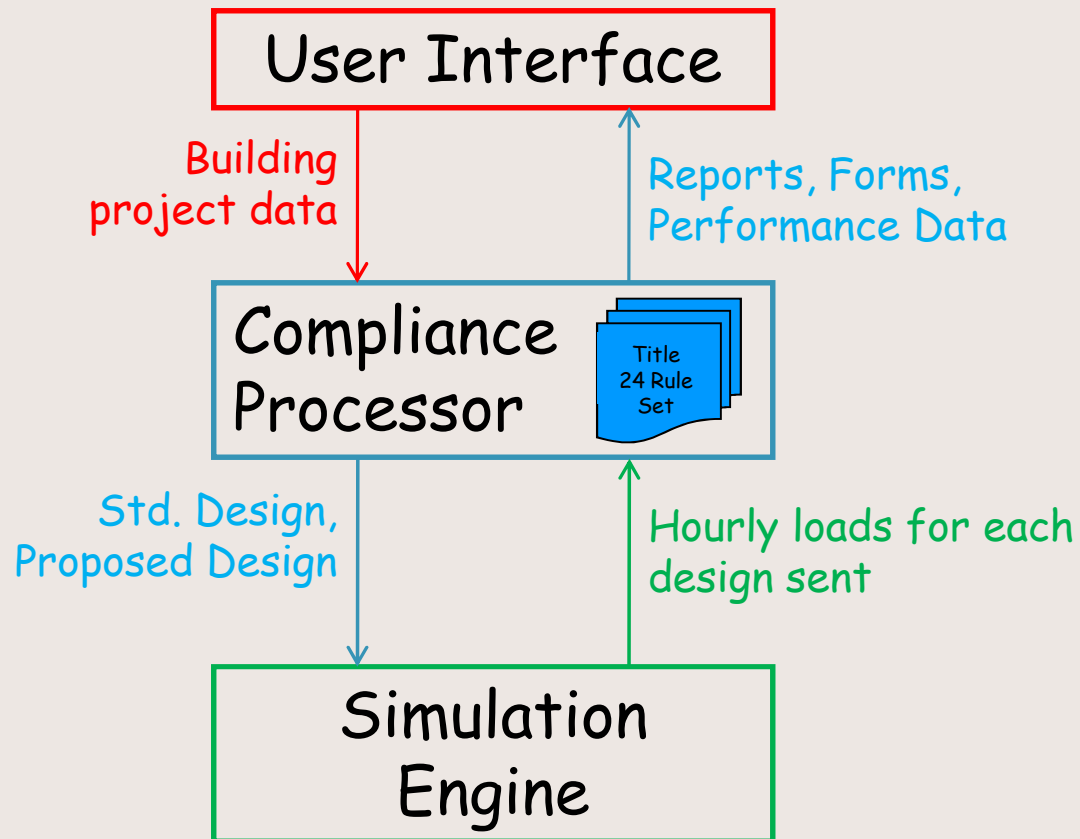
Multiple rule sets can be generated

Software Tools can deploy multiple rule sets



**"EBAR" = Existing Building Asset Rating**

# Future Software Architecture



# Software Development & Analysis Future

## Building Energy Analysis Collaborative (BEAC)

- Non-profit organization to develop, test, document, support energy simulation software and special function processors/applications
- Workforce development is a critical component
  - Age based membership pricing?

# Software Development & Analysis Future

BEAC would manage and make available:

- Simulation software for Standards development, compliance, HERS II, utility incentive programs, general energy analysis
- Building & energy system prototypes, weather & solar radiation data, etc.
- Algorithm development and energy analysis projects
  - Sponsored by organizations in need
  - Completed by BEAC members
  - Tested & approved by BEAC-established processes
- Documentation, tutorials



The End.



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