



City of Boulder Energy Codes

*Long-Term Strategy to get to Net Zero Energy and Beyond*

Getting to Zero Forum  
October xx, 2016



**BACKGROUND AND  
CONTEXT**

## THE IMPORTANCE OF NET ZERO ENERGY CODES

**DRAFT CLIMATE COMMITMENT:**  
Reduce GHG Emissions 80% by 2050

**NET ZERO ENERGY (NZE):**  
Renewable Energy Production  $\geq$  Annual Site Energy Consumption

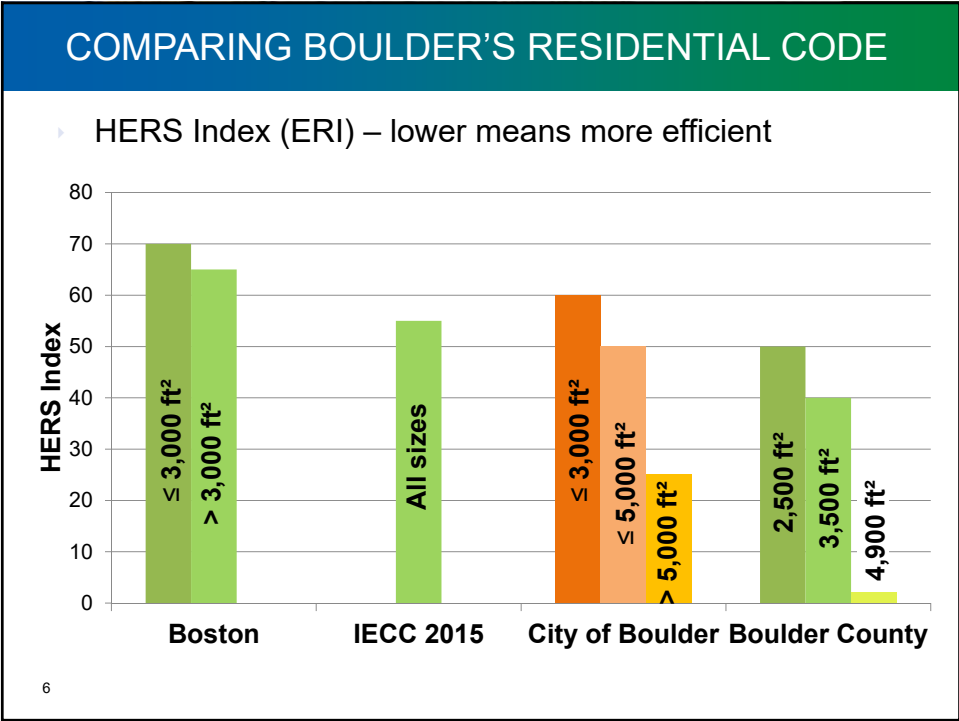
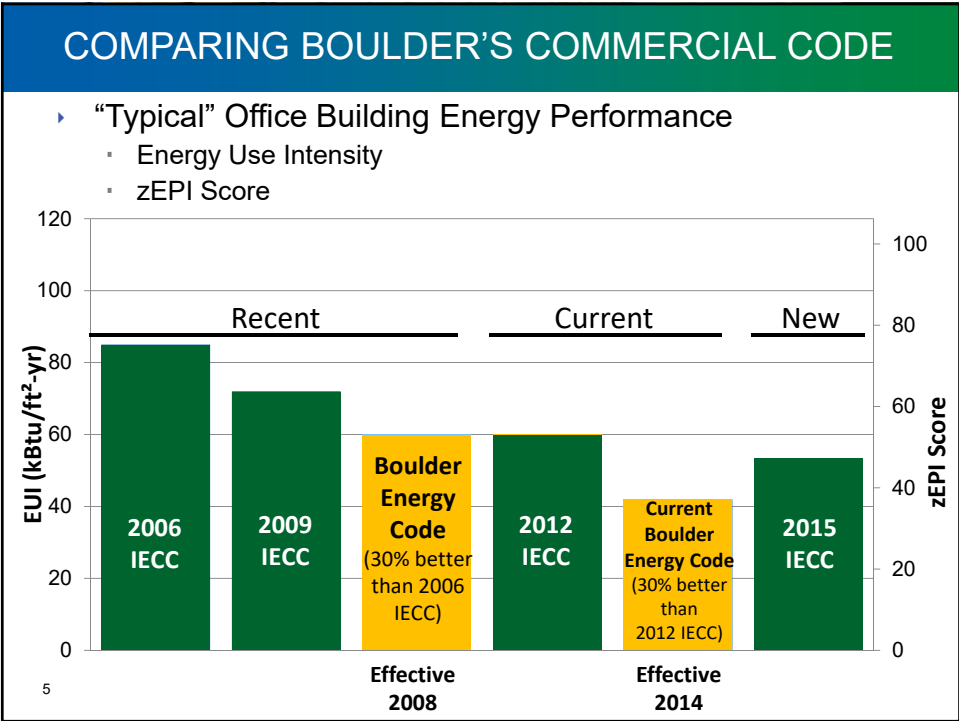
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## NATIONAL CODES, INDICES AND METRICS

I am hoping this information will be covered in an earlier presentation and I can delete this

- ▶ **ICC** – International Code Council
- ▶ **IECC** – International Energy Conservation Code
- ▶ **IgCC** – International Green Construction Code
- ▶ **EUI** – Energy Use Intensity
- ▶ **HERS Index/ERI** – Home Energy Rating System / Energy Rating Index
- ▶ **zEPI** – Zero Energy Performance Index

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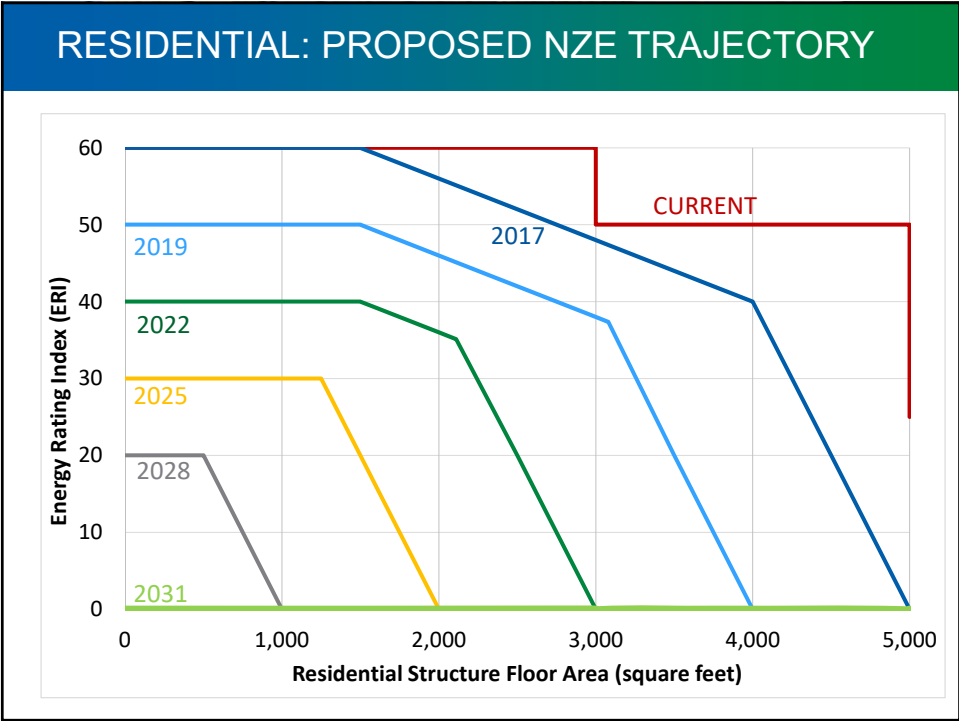


KEY COMPONENTS OF LONG TERM STRATEGY		
Strategy Component	Description	Timeline
NZE Schedule	Phase in NZE requirements by house size or building type	2017-2031
Phase in non-energy sustainability requirements	For commercial buildings, adopt portions of IgCC over time. For residential, adopt local amendments to IRC.	2017-2031
Off-site Renewables	Allow community solar to count for code compliance ( <i>only when on-site is infeasible</i> )	2017

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KEY COMPONENTS OF LONG TERM STRATEGY		
Strategy Component	Description	Timeline
Require Base Level of Efficiency	Maximum ratings before renewables: ERI = 50, zEPI = 45	2017-2019
Outcome Based Codes (commercial bldgs.)	Pilot a voluntary outcome based energy code – tied to actual, measured energy consumption of the building post-occupancy	2019
Early Adopter Incentives	Incentives for buildings to be NZE before it is required by code	2020
Encourage All Electric Buildings	Adopt code amendments or incentives to discourage the installation of natural gas equip.	2022

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## COMMERCIAL PROGRESS TO NET ZERO: PROPOSED APPROACH

Require NZE sooner (recommendation: 2028) for lower energy intensity buildings types (e.g. office, warehouse and retail buildings)

A phased approach allows the industry and staff time to adjust to these requirements and adopt best practices before this applies to all commercial buildings

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## NON ENERGY SUSTAINABILITY REQUIREMENTS

### Proposed for 2017 Code Updates

- Waste Management
- Preservation of Natural Resources
- Solar PV "Ready"
- Electric Vehicle (EV) Charging Infrastructure
- Water Efficiency

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**NON ENERGY SUSTAINABILITY F** Work in progress

**Phased in over future years**

- Waste Management (commercial)
- Sustainable Products and Materials
- Transportation Requirements (bike infrastructure, preferred parking, etc.)
- Xx
- xx

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**OFF-SITE RENEWABLES**

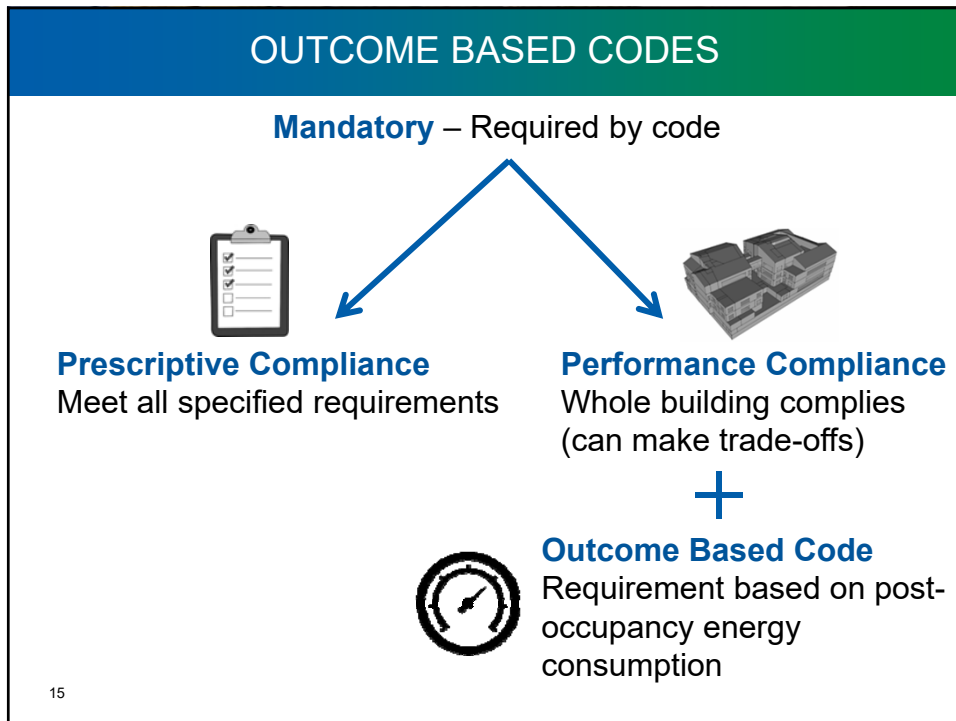
- ▶ Proposed for 2017: Allowed to contribute to required ERI score (residential) IF:
  - ▶ on-site options are exhausted, and
  - ▶ An ERI of 50 has been achieved prior to off-site renewables.
- ▶ Will be allowed for commercial code compliance starting in 2019, when the stringency of that code is increased.
- ▶ Exceptions may be needed if Community Solar is oversubscribed

Community Solar

Approved Carbon Offset Funds

~~Renewable Energy Credits (RECs)~~

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### OUTCOME BASED CODES


- ▶ This slide will show more info about outcome based codes and how they would be utilized in the future

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DISCUSSION AND Q&A



Aerial view of a campus with green lawns, trees, and a parking lot.



REFERENCE SLIDES



Aerial view of a campus with green lawns, trees, and a parking lot.

PRELIMINARY COST BENEFIT ANALYSIS	
Code Change	Cost Impact
ERI more stringent (~10) for homes 2000 – 4000 sf	~\$3.00/sf ~\$9000 for a 3,000 sf home (~1-2% of const. costs)
Net Zero Energy for homes larger than 5,000 sf	~\$28,000 in solar PV (Payback of ~ 15 years) (~1-2.5% of const. costs)
Streamline Green Points	Should be a net cost savings by removing many of less impactful measures
Revise Commercial Prescriptive Path	Should be a neutral impact because most requirements are being streamlined and simplified, but solar PV is now required
Electric Vehicle Charging	See next slide

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CURRENT RESIDENTIAL GREEN CODE		
<b>GREEN BUILDING</b>	+	<b>GREEN POINTS</b>
<ol style="list-style-type: none"> <li>1. Energy efficiency requirements</li> <li>2. Deconstruction and Construction waste diversion requirements</li> <li>3. Energy audits for renovations and additions</li> </ol>		Requires a certain number green building measures that go above just energy use.
Maximum ERI		Required Green Points
≤ 3,000 ft <sup>2</sup> - 60		≤ 3,000 ft <sup>2</sup> - 20
≤ 5,000 ft <sup>2</sup> - 50		≤ 5,000 ft <sup>2</sup> - 40
> 5,000 ft <sup>2</sup> - 25		> 5,000 ft <sup>2</sup> - 60
Multifamily Units - 60		Multifamily Units - 10-30*
<i>*depends on size of units</i>		

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## CURRENT COMMERCIAL ENERGY CODE

- Performance {
  - 30% better than IECC 2012
- Prescriptive {
  - Custom
- Green Code {
  - Covered in other aspects of the codes and design standards

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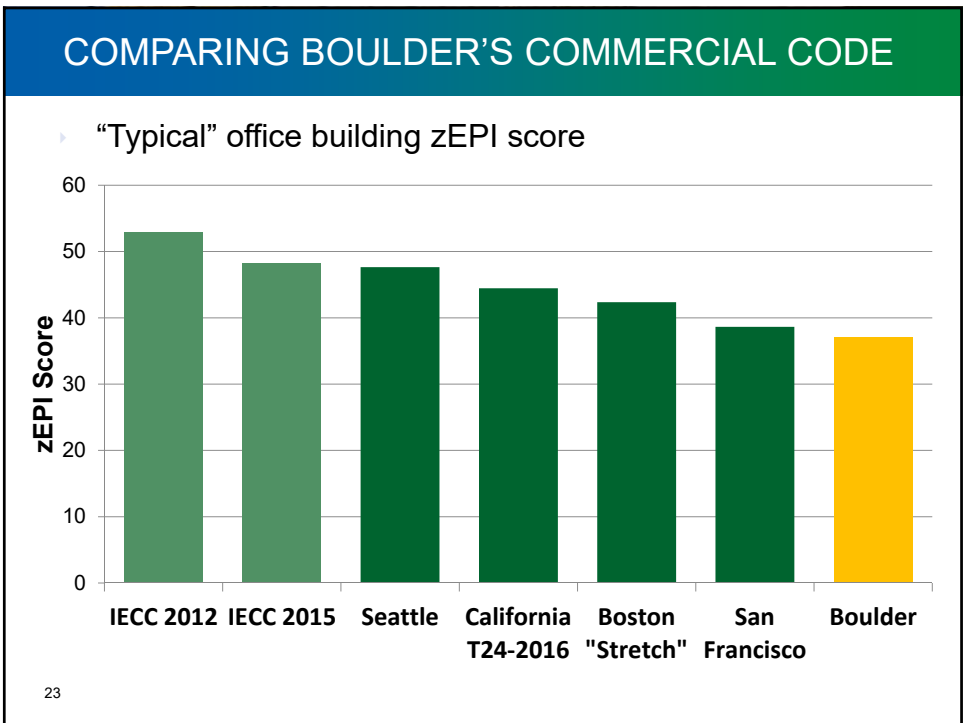
## WHAT DOES NET ZERO LOOK LIKE?

### Net Zero Energy Definition

The amount of renewable energy produced on site, *plus that purchased from approved community energy systems or carbon offset programs*, is equal to the annual energy consumption of the site.

Year	Consumption	Renewables (On site)	Renewables (Off site)	Net Total
Now	High	Low	None	Positive
Mid '20s	Medium	Medium	None	Close to Zero
2031	Low	Low	Low	Zero


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### (3) ELECTRIC VEHICLE (EV) CHARGING STATIONS


**Level 1- 120 V outlet (\$100s)**

- Add dedicated breaker, Longer charge time




**Level 2 - 240 V outlet (\$1,000s)**

- Requires Level 2 charging station OR wall station
- Faster than Level 1



**Level 3/DC fast charging station (\$10,000s)**

- Electrical infrastructure
- Soft costs, siting and permits
- Equipment and installation
- Not compatible for all EVs



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### (3) EV CHARGING STATIONS

#### Dwellings with dedicated off-street parking

- ▶ Require a 120 V and 240 V outlet
- ▶ ~\$350-500 per unit

#### Offices, Industrial Buildings, and Multifamily\*

- ▶ Require EV Ready (120 V and 240 V outlets) for 7.5% of parking spaces (~\$850 per space)
- ▶ Require Level 2 dual port charging stations (~\$4,000-6,000) for 2.5% of parking spaces
- *Exception if less than 25 parking spaces*
- *Lodging facilities will be required to install Level 2, dual port stations for 1% of parking spots (a minimum of 1).*

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### KEY COMPONENTS OF LONG TERM STRATEGY (ATTACHMENT A)

- ▶ 6 year cycle for major code adoption, with local evaluation and updates every 3 years
- ▶ Accelerate NZE
- ▶ Require Base Level of Efficiency before Renewables
- ▶ Outcome Based Codes
- ▶ Phase in IgCC Requirements
- ▶ Allow Off-site Renewables
- ▶ Early Adopter Incentives
- ▶ Encourage All Electric Buildings

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## PROPOSED RESIDENTIAL ENERGY CODE UPDATES

- 1 Eliminate the “point” structure and prioritize key measures as **mandatory**
- 2 Implement a sliding scale of ERI scores per floor area (> 5,000 sf required to be NZE)
- 3 Revise the ERI requirements for additions
- 4 Revise requirements for alterations

### (3) RESIDENTIAL ADDITIONS: PROPOSED CHANGES

#### CURRENT

- ▶ Multiple look up tables based on size of addition and finished house
- ▶ Separate new construction requirement “triggers”
- ▶ Below those triggers, smaller additions are unfairly penalized

#### PROPOSED

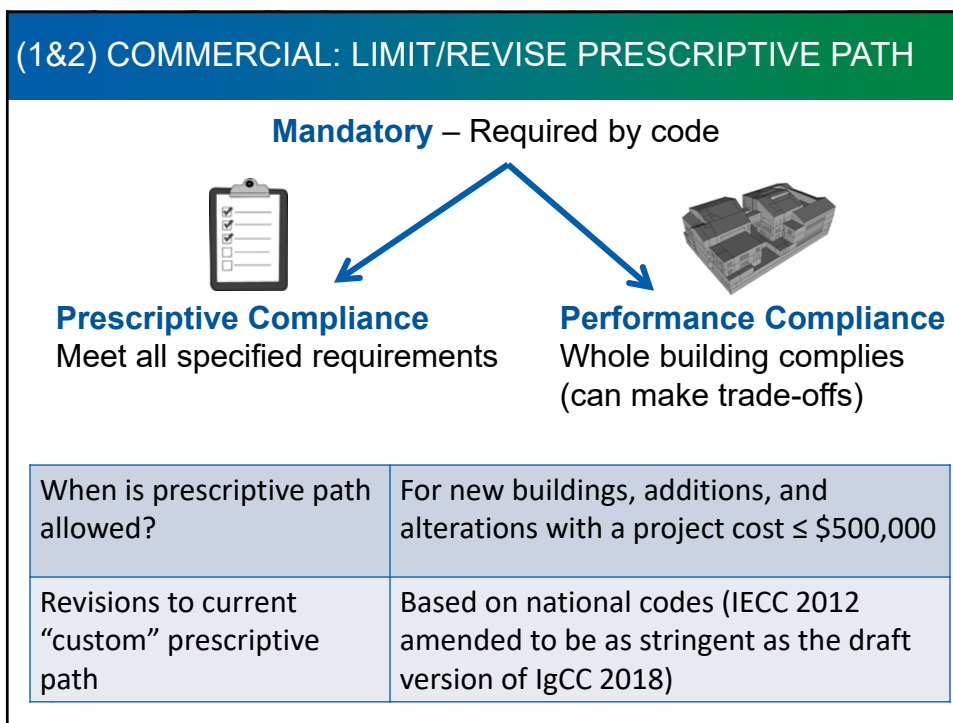
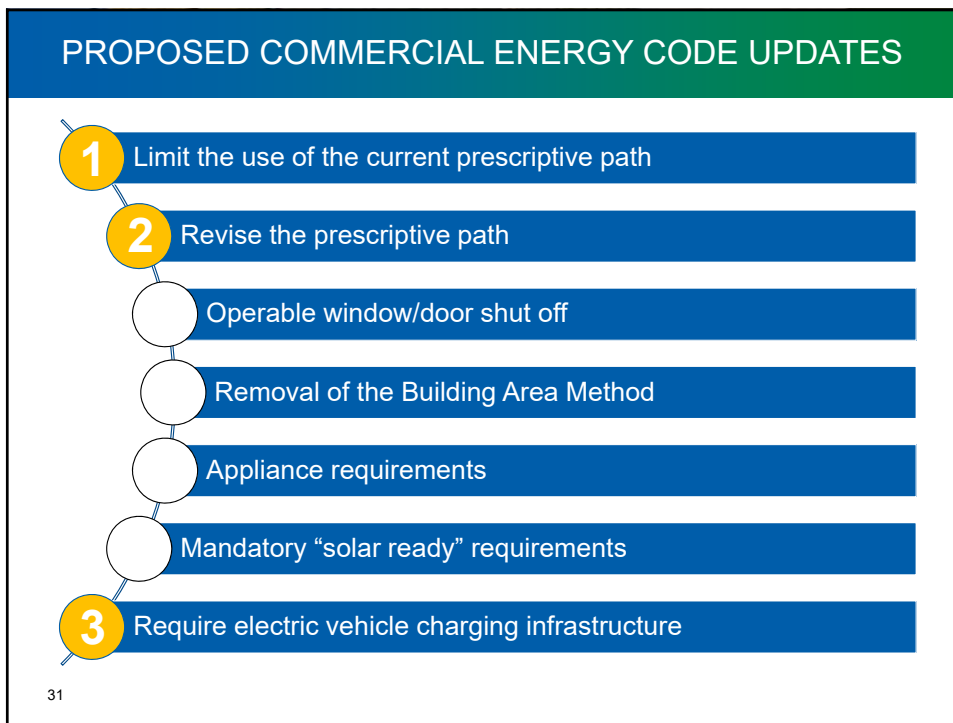
- ▶ Additions < 1,000 sf shall meet prescriptive requirements of IECC 2012
- ▶ Larger additions will use a single lookup table/online tool to determine required ERI
- ▶ Requirements more stringent for larger homes, and for adding a large addition as a high % of existing sf

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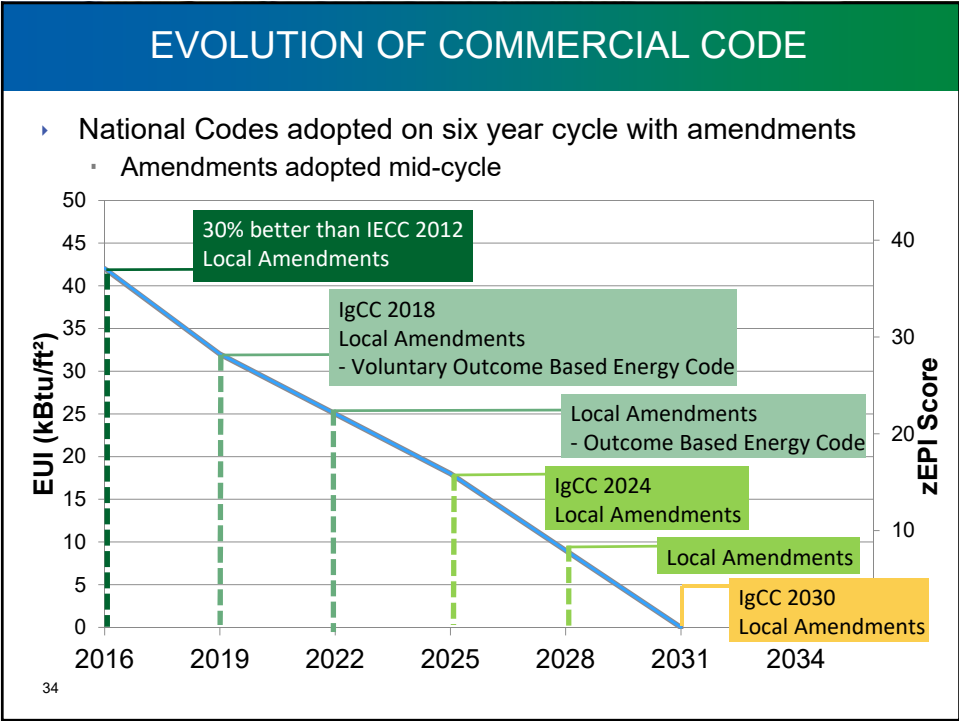
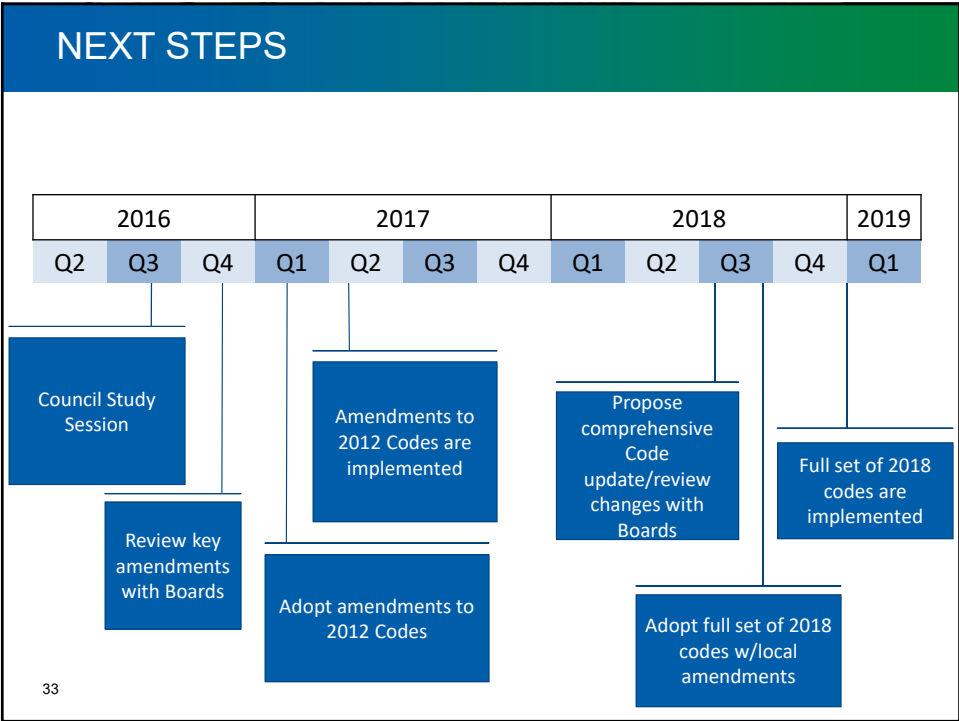
### (4) RESIDENTIAL ALTERATIONS: PROPOSED CHANGES

	Percent of Project Cost to Assessed Value of Existing Property		
	≤20%	21-50%	≥51%
<b>Measures</b>	All energy and building code requirements (for the scope of the alteration)		
	EnergySmart Advising	EnergySmart Audit and Advising	Triggers new construction requirements
		Air sealing and insulation in ceiling and walls	
		Crawl space conditioning	

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# HOME ENERGY RATING SYSTEM (HERS/ERI) <sup>TD12</sup>

**HERS Score:**

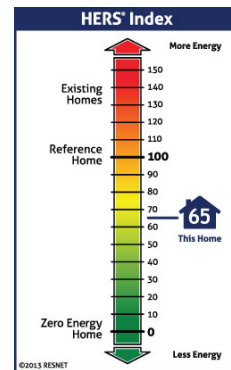
- Over 100 less efficient than IECC 2006
- 100 = IECC 2006
- 0 = Net Zero Energy

Standard construction practices:

- Maximize thermal envelope + mechanical systems = HERS 35-40
- Below HERS 35 = quantity of solar installed

Variables include:

- Lot and house orientation
- Design
- Amount of glazing
- Solar Area 1, 2 or 3
- Roof capacity for PV
- Large mature trees
- Off-site carbon off-set options



## Slide 35

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**TD12** Do we need this slide? Can we explain the HERS in the previous slide as it is mentioned next to other indices?

Thacker, Dave, 8/9/2016