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 ≥ Annual Site
Energy Consumption

NATIONAL CODES, INDICES AND METRICS

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

I am hoping this information will be covered in an earlier presentation and I can delete this
COMPARING BOULDER’S COMMERCIAL CODE

- “Typical” Office Building Energy Performance
  - Energy Use Intensity
  - zEPI Score

<table>
<thead>
<tr>
<th>Year</th>
<th>Effective</th>
<th>Recent</th>
<th>Current</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006 IECC</td>
<td>Effective 2008</td>
<td>70</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>2009 IECC</td>
<td>Effective 2008</td>
<td>60</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>2012 IECC</td>
<td>Effective 2014</td>
<td>50</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>2015 IECC</td>
<td>Effective 2014</td>
<td>40</td>
<td>40</td>
<td>30</td>
</tr>
</tbody>
</table>

COMPARING BOULDER’S RESIDENTIAL CODE

- HERS Index (ERI) – lower means more efficient

<table>
<thead>
<tr>
<th>Size</th>
<th>Boston</th>
<th>IECC 2015</th>
<th>City of Boulder</th>
<th>Boulder County</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 3,000 ft²</td>
<td>70</td>
<td>60</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>&gt; 3,000 ft²</td>
<td>70</td>
<td>60</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>&lt;= 5,000 ft²</td>
<td>65</td>
<td>60</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>&gt; 5,000 ft²</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>2,500 ft²</td>
<td>55</td>
<td>50</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>3,500 ft²</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>4,900 ft²</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>40</td>
</tr>
</tbody>
</table>
## Long Term Strategy and Pathway to Net Zero Energy Buildings

### Key Components of Long Term Strategy

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

*Image credit: University of Colorado Boulder*
### KEY COMPONENTS OF LONG TERM STRATEGY

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

### RESIDENTIAL: PROPOSED NZE TRAJECTORY

![Graph](image)
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

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
NON ENERGY SUSTAINABILITY

Phased in over future years

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

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)
OUTCOME BASED CODES

**Mandatory** – Required by code

- **Prescriptive Compliance**
  - Meet all specified requirements

- **Performance Compliance**
  - Whole building complies (can make trade-offs)

- **Outcome Based Code**
  - Requirement based on post-occupancy energy consumption

This slide will show more info about outcome based codes and how they would be utilized in the future.
DISCUSSION AND Q&A

REFERENCE SLIDES
PRELIMINARY COST BENEFIT ANALYSIS

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

CURRENT RESIDENTIAL GREEN CODE

GREEN BUILDING
1. Energy efficiency requirements
2. Deconstruction and Construction waste diversion requirements
3. Energy audits for renovations and additions

GREEN POINTS
Requires a certain number green building measures that go above just energy use.

<table>
<thead>
<tr>
<th>Maximum ERI</th>
<th>Required Green Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 3,000 ft² - 60</td>
<td>≤ 3,000 ft² - 20</td>
</tr>
<tr>
<td>≤ 5,000 ft² - 50</td>
<td>≤ 5,000 ft² - 40</td>
</tr>
<tr>
<td>&gt; 5,000 ft² - 25</td>
<td>&gt; 5,000 ft² - 60</td>
</tr>
<tr>
<td>Multifamily Units - 60</td>
<td>Multifamily Units - 10-30*</td>
</tr>
</tbody>
</table>

*depends on size of units
CURRENT COMMERCIAL ENERGY CODE

Performance
- 30% better than IECC 2012

Prescriptive
- Custom

Green Code
- Covered in other aspects of the codes and design standards

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.
"Typical" office building zEPI score

IECC 2012 | IECC 2015 | Seattle | California T24-2016 | Boston "Stretch" | San Francisco | Boulder
---|---|---|---|---|---|---
50 | 50 | 45 | 40 | 35 | 30 | 25

(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
(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).

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
2016/2017 ENERGY CODE UPDATE

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

(4) RESIDENTIAL ALTERATIONS: PROPOSED CHANGES

<table>
<thead>
<tr>
<th>Percent of Project Cost to Assessed Value of Existing Property</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤20%</td>
<td>21-50%</td>
</tr>
<tr>
<td>All energy and building code requirements (for the scope of the alteration)</td>
<td>EnergySmart Advising</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>
PROPOSED COMMERCIAL ENERGY CODE UPDATES

1. Limit the use of the current prescriptive path
2. Revise the prescriptive path
   - Operable window/door shut off
   - Removal of the Building Area Method
   - Appliance requirements
   - Mandatory “solar ready” requirements
3. Require electric vehicle charging infrastructure

(1&2) COMMERCIAL: LIMIT/REVISE PRESCRIPTIVE PATH

**Mandatory** – Required by code

**Prescriptive Compliance**
Meet all specified requirements

**Performance Compliance**
Whole building complies (can make trade-offs)

<table>
<thead>
<tr>
<th>When is prescriptive path allowed?</th>
<th>For new buildings, additions, and alterations with a project cost ≤ $500,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revisions to current “custom” prescriptive path</td>
<td>Based on national codes (IECC 2012 amended to be as stringent as the draft version of IgCC 2018)</td>
</tr>
</tbody>
</table>
NEXT STEPS

<table>
<thead>
<tr>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td>Q1</td>
</tr>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
</tbody>
</table>

- Council Study Session
- Amendments to 2012 Codes are implemented
- Propose comprehensive Code update/review changes with Boards
- Full set of 2018 codes are implemented
- Adopt amendments to 2012 Codes
- Adopt full set of 2018 codes w/local amendments
- Review key amendments with Boards

EVOLUTION OF COMMERCIAL CODE

- National Codes adopted on six year cycle with amendments
  - Amendments adopted mid-cycle

- 30% better than IECC 2012
- IgCC 2018
- Local Amendments
  - Voluntary Outcome Based Energy Code
- IgCC 2024
- Local Amendments
- IgCC 2030
- Local Amendments
- Local Amendments
- Local Amendments
HOME ENERGY RATING SYSTEM (HERS/ERI)

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

HERS Score:

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