Zero Carbon and Zero Energy Codes: Key Policy Tools to Meet Climate Goals

June 2, 2019

Jim Edelson
JOIN US IN OAKLAND!

Join us at the premier global event dedicated to creating a zero energy, zero carbon future for the built environment.

GETTING TO ZERO FORUM 2019

October 9-11
OAKLAND MARRIOTT
Oakland, CA

goingtozerooforum.org
AMERICA IS STILL IN. ARE YOU?

Join more than 3,500 organizations and show the world that we stand by the Paris Climate Agreement and are committed to meeting its goals.

COMMIT TO CLIMATE ACTION

WE ARE 3,594 LEADERS STRONG

REPRESENTING 169.0 MILLION PEOPLE

ACROSS 50 STATES

TOTALING $$$$ 9.46 TRILLION $$ IN GDP

https://www.wearestillin.com/
Achieving Paris Agreement = Urgent action towards Net Zero Carbon Buildings

Courtesy: Andrew Laski WGBC
Cross-sector growth in U.S. and Canada
Global ZE Investment

• ZE Market equipment assessment 2017-2021 (Technavio)
• 39% Compound Annual Growth Rate (CAGR)
• HVAC, controls, insulation glazing, lighting, H2O heating
• Public, commercial and residential buildings
Roadmap Framework

- Established Priorities
- Targets or Goals
- Strategies
- Pathway to Goals
- Expected Outcomes

Consider: The roadmap may ultimately be a technical document that the general public might find difficult to understand for implementation. The overarching framework should be understandable and have a public facing framework for greater community adoption.

Also consider: Factor time into goal completion date for roadmap development.
Targeted Audience

• Target audience should be your implementers. Public buildings, government, utilities builders, designers, general public.

• Consider the audiences individual actions when formatting your framework

• Ultimately since the general public will be crucial to implementation – the roadmap should have a public facing framework within the document that can be shared or easily understood.
Timeline

- Timeframe needed to develop action to scale
- Recommendations for near term (critical), mid term and long term
- Goals as compared to other important timelines either already set to occur or needed for implementation: codes, elections, efficiency plans already in place, priorities (city/state) large portfolio holder timelines, etc.
- In timeline address the goals, strategies, action items and short/mid/long term goals for each decision or goal

*Consider:* Time Certain Requirements: Upgrades/Actions by a certain date. (lighting, efficiency, natural gas dependency

All new commercial construction in California will be zero net energy by 2030
Zero Energy Building (*NBI Getting to Zero*)

A Zero Energy (ZE) building* is highly energy efficient and meets ≥100% of its annual energy from renewables.

**Energy** = All energy (electric, gas, steam, liquid fuel etc.) consumed on site

**Net** = One year or more of on-site renewable energy production minus energy use

**Verified** = A year of more of documented performance at net zero

**Emerging** = not yet a year or more of data (may be on a path to ZE)

**EUI** = Energy Use Intensity in kBtu/sf/yr - metric of energy performance.

*Also known as Net Zero Energy (NZE), or Zero Net Energy (ZNE). Zero Energy Building (ZEB)
Four Foundations to Support Zero Carbon Building Policies

✓ Energy Efficiency – makes each of the other 3 foundations more achievable
✓ Renewable Energy Sources – onsite generation and offsite procurement
✓ Building / Grid Integration - account for and manage impacts on energy supply grids
✓ Building Decarbonization and Electrification – reduction/elimination of onsite combustion is central to many policy frameworks, but not essential to all zero carbon building policies
Zero Energy Definitions - Source

DOE released A Common Definition for Zero Energy Buildings in September 2015: A Zero Energy Building (ZEB) is an energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

CA DGS State Administrative Manual (SAM) Section 1815.31
ZNE Definition: Energy Efficient building that produces as much clean renewable energy as it consumes over the course of a year, when accounted for at the energy generation source. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all fuel extraction, transmission, delivery, and production losses. By taking all energy use into account, the ZNE definition provides a complete assessment of energy used in buildings.
Advancing Net Zero

WorldGBC definition:
A net zero carbon building is highly energy efficient with all remaining energy from on-site and/or off-site renewable sources.

100% of buildings must operate at net zero carbon by 2050.

All new buildings must operate at net zero carbon by 2030.

GOVERNMENT ENGAGEMENT

TRAINING & EDUCATION

CORPORATE ENGAGEMENT

CERTIFICATION

Version 1 | March 2018
Zero Carbon Building Definition

• A zero carbon building is defined as one that is highly energy-efficient and produces onsite, or procures, carbon-free renewable energy in an amount sufficient to offset the annual carbon emissions associated with operations.

• (Source: Zero Carbon Building Standard Canada Green Building Council)
IPEEC Zero Energy Building International Review

• Prepared Summer 2018 for the International Partnership for Energy Efficiency Cooperation (IPEEC)

• Reviews International ZE Related Definitions and Policy Activity

Available at:
Time-Dependent Source Energy  (California, Eley)
The building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4. of the 2015 International Energy Conservation Code.

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>ENERGY RATING INDEX not including onsite power</th>
<th>ENERGY RATING INDEX including onsite power (as proposed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>47</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>47</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>47</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>46</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>46</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>45</td>
<td>0</td>
</tr>
</tbody>
</table>

* The building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4. of the 2015 International Energy Conservation Code.
## Other Zero Codes/Policies

<table>
<thead>
<tr>
<th>Code/Order</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZERO Code – California (proposed/alternate) and generic with supporting tools (Arch 2030)</td>
<td>Commercial; based on 90.1-2016 or other baseline (i.e. Title 24); onsite or offsite renewables</td>
</tr>
<tr>
<td>Title 24-2019 – California statewide code</td>
<td>Residential; based on HERS-like EDR plus renewables plus grid compatibility</td>
</tr>
<tr>
<td>Appendix Z – Washington D.C alternate compliance path</td>
<td>Commercial; outcome based compliance path at ZE levels</td>
</tr>
<tr>
<td>Oregon Executive Order No. 10-20</td>
<td>Residential; Zero Energy Ready Home in code by 2022</td>
</tr>
</tbody>
</table>
Net Zero New Construction by 2035

US DOE Codes Conference – Denver CO
Denver’s Path To Net Zero Energy – Residential

Denver’s Code Today

Trajectory for New Buildings ZE by 2030

© New Buildings Institute
Net Zero New Construction by 2035
Work Plan

• Green Building Ordinance
• Adopting IECC 2018 – Base Code + Amendments
• Adopting IgCC 2018 – voluntary Stretch Code
• Code Compliance Study and Implementation
• National IECC 2021 development and voting
• Road Map to Net Zero by 2035
Green Building Ordinance - Compliance Options for New Buildings

**Cool Roof Required*** Plus ONE of the Following Options:

**Green Roof / Green Space**
- Anywhere on building or zone lot
- Green area equivalent to the lesser of:
  - 10% of gross floor area of the building
  - 60% of the total roof area
  - Available roof space

**Pay for Offsite Green**
- Payment to Green Building Fund of:
  - $50.00 per square foot of green space coverage required but not provided

**Green Plus Solar or Energy Efficiency**
- Anywhere on building or zone lot, or off-site for solar
- Green area equivalent to the lesser of:
  - 3% gross floor area
  - 18% of total roof area
  - Available roof space
- COMBINED WITH ONE OF THE FOLLOWING:
  1) Onsite solar equivalent to the lesser of:
     - 7% of the floor area
     - 42% of total roof area
  2) Offsite solar equivalent to the onsite solar plus a minimum 2.5% energy cost savings from energy efficiency above code
  3) 5% energy cost savings from energy efficiency above code

**Solar or Energy Efficiency**
- Anywhere on building or zone lot, or off-site
- Onsite solar or other renewable equiv. to your choice of:
  - 70% of the total roof area
  - 100% of annual average electricity used at the building
- Proof that the building is Net Zero
  OR
  Offsite solar equiv. to your choice of:
  - 100% of building electricity use
  - Amount equivalent to required onsite solar plus minimum 6% energy cost savings from energy
  OR
  Minimum 12% energy cost savings from energy efficiency above code

**Certification**
- One of the following:
  - LEED Certification, minimum gold
  - Enterprise Green Communities certification
  - National Green Building Standard ICC/ASHRAE 700
  - Equivalent certification approved by the building official

* If the proposed roof is a character-defining roof, CPD may allow alternative roof materials
2019 Code Adoption Process

Amendment Proposal Development
- Jan-April
- Anyone may submit an amendment.

Code Committee Meetings
- April-August

Code Adoption – City Council Process
- Fall 2019
<table>
<thead>
<tr>
<th>Week of</th>
<th>Mon.</th>
<th>Tues.</th>
<th>Wed.</th>
<th>Thurs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 15 -Orientation</td>
<td>IFC-SC</td>
<td>M/P/Fg</td>
<td>IECC</td>
<td></td>
</tr>
<tr>
<td>April 22 - Orientation</td>
<td>IGCC</td>
<td>IFC</td>
<td>IRC</td>
<td>IBC/IEBC</td>
</tr>
<tr>
<td>April 29</td>
<td>– no meetings –</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 6</td>
<td>– no meetings –</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 13</td>
<td>IFC-SC</td>
<td>M/P/Fg</td>
<td>IECC</td>
<td></td>
</tr>
<tr>
<td>May 20</td>
<td>IGCC</td>
<td>IFC</td>
<td>IRC</td>
<td>IBC/IEBC</td>
</tr>
<tr>
<td>May 27</td>
<td>IFC-SC</td>
<td>M/P/Fg</td>
<td>IECC</td>
<td></td>
</tr>
<tr>
<td>June 3</td>
<td>– no meetings –</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June 10</td>
<td>IGCC</td>
<td>IFC</td>
<td>IRC</td>
<td>IBC/IEBC</td>
</tr>
<tr>
<td>June 17</td>
<td>IFC-SC</td>
<td>M/P/Fg</td>
<td>IECC</td>
<td></td>
</tr>
<tr>
<td>June 24</td>
<td>– no meetings –</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 1</td>
<td>IGCC</td>
<td>IFC</td>
<td>IRC</td>
<td>July 4 – MTG. MOVED TO MON. *</td>
</tr>
<tr>
<td>July 8</td>
<td>*IBC/IEBC</td>
<td>IFC-SC</td>
<td>M/P/Fg</td>
<td>IECC</td>
</tr>
<tr>
<td>July 15</td>
<td>– no meetings –</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 22</td>
<td>IGCC</td>
<td>IFC</td>
<td>IRC</td>
<td>IBC/IEBC</td>
</tr>
<tr>
<td>July 29</td>
<td>IFC-SC</td>
<td>M/P/Fg</td>
<td>IECC</td>
<td></td>
</tr>
<tr>
<td>August 5</td>
<td>IGCC</td>
<td>IFC</td>
<td>IRC</td>
<td>IBC/IEBC</td>
</tr>
</tbody>
</table>
Range of Residential Amendments to 2018 IECC

- Duct Location
- Duct Testing
- ERI
- EV Charging
- Exterior Lighting for Group R Occupancies
- Fenestration (U-factor)
- Flex Points
- Grade 1 Insulation

- Homeowners' Manual
- Interior Lighting Efficacy Modeling
- Opaque Envelope U-factor
- Prohibit Pilot Lights
- Retire RECs used for ERI Compliance
- Whole-House Ventilation Fans
Range of Commercial Amendments to 2018 IECC

- Above-Grade Wall Definition
- Air Barrier - Commissioning
- Air Barrier - Testing
- C406 Points Option
- Controlled Receptacles
- Cx in Additions
- Cx in Alterations
- Dwelling Unit Ltg. Efficacy
- Building leakage calculations on plans

- Horticulture Lighting
- Lighting Power Densities
- Low-Power Fan Efficency
- Mechanical Penetrations
- Parking Lot Lighting
- Thermal Bridging
- Energy recovery ventilation
- Staged air volume - RTU’s
Thank you