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

June 2, 2019

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JOIN US IN OAKLAND!

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

nbi new buildings
institute



GETTING TO
zero
FORUM 2019

October 9-11
OAKLAND MARRIOTT
Oakland, CA
gettingtozeroforum.org

WE ARE STILL IN

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, the undersigned mayors, county executives, governors, tribal leaders, college and university leaders, businesses, faith groups, and investors are joining forces for the first time to declare that we will continue to support climate action to meet the Paris Agreement.

[The Declaration >](#)

WE ARE **3,594** LEADERS STRONG

REPRESENTING

169.0 MILLION

 PEOPLE

ACROSS

50 

STATES

TOTALING \$\$\$

9.46 TRILLION

\$\$\$ \$ IN GDP

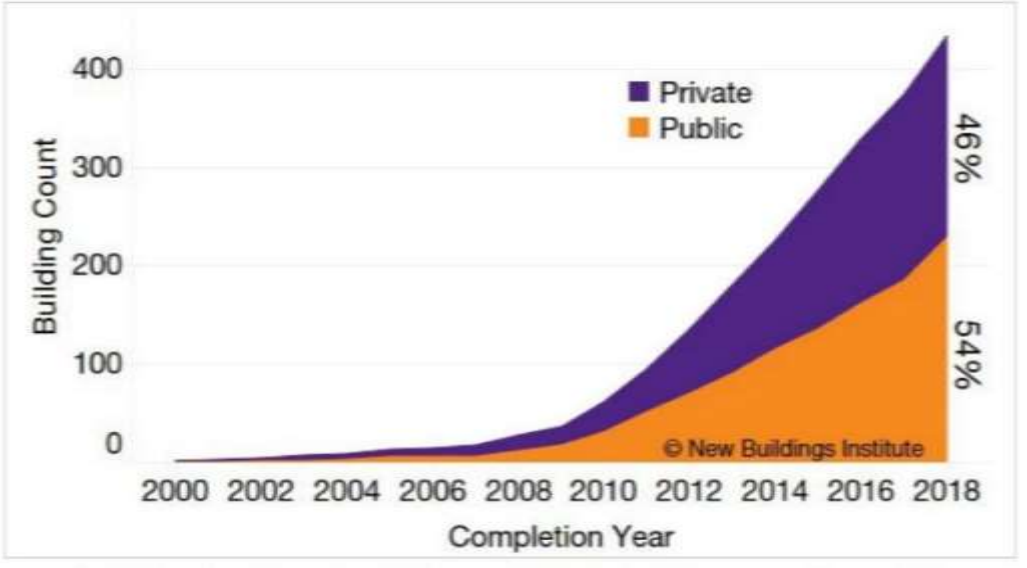
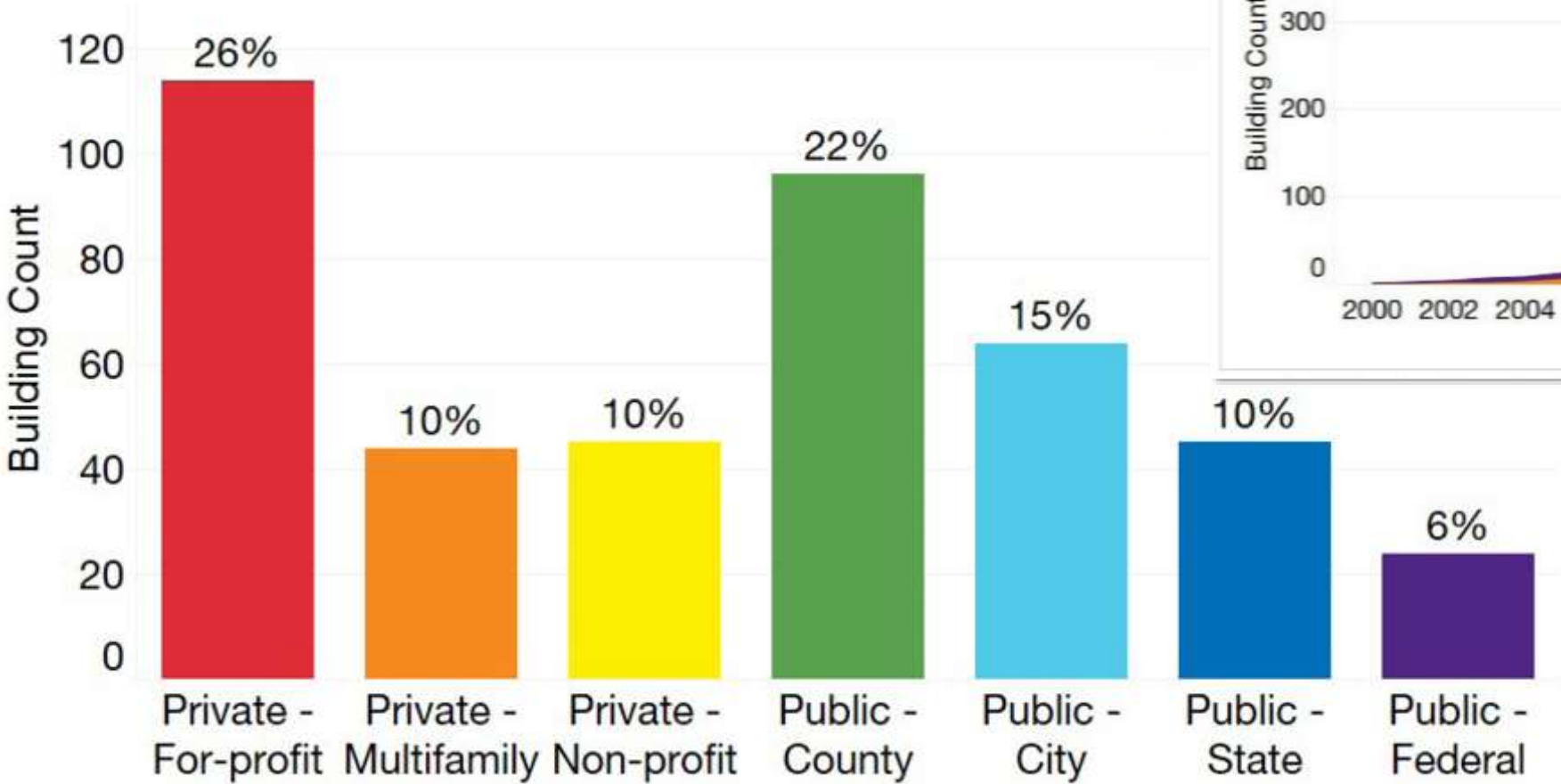


Achieving Paris Agreement

=

Urgent action towards
Net Zero Carbon Buildings

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

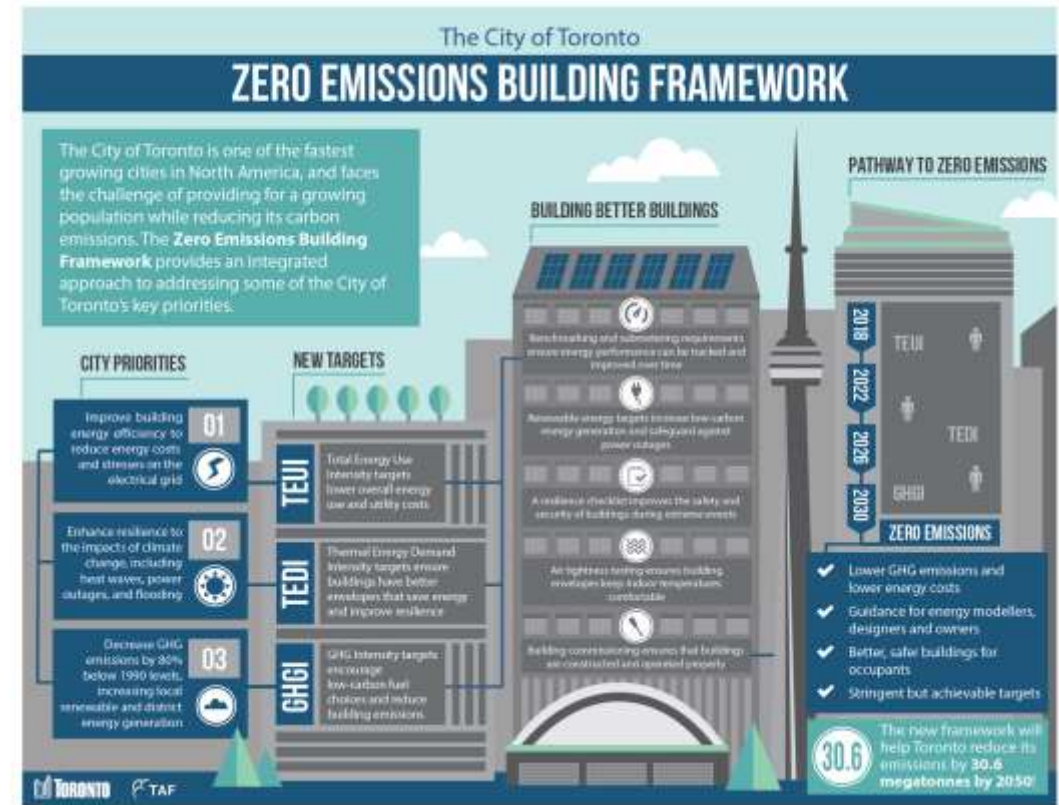


Roadmap Framework

- 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.



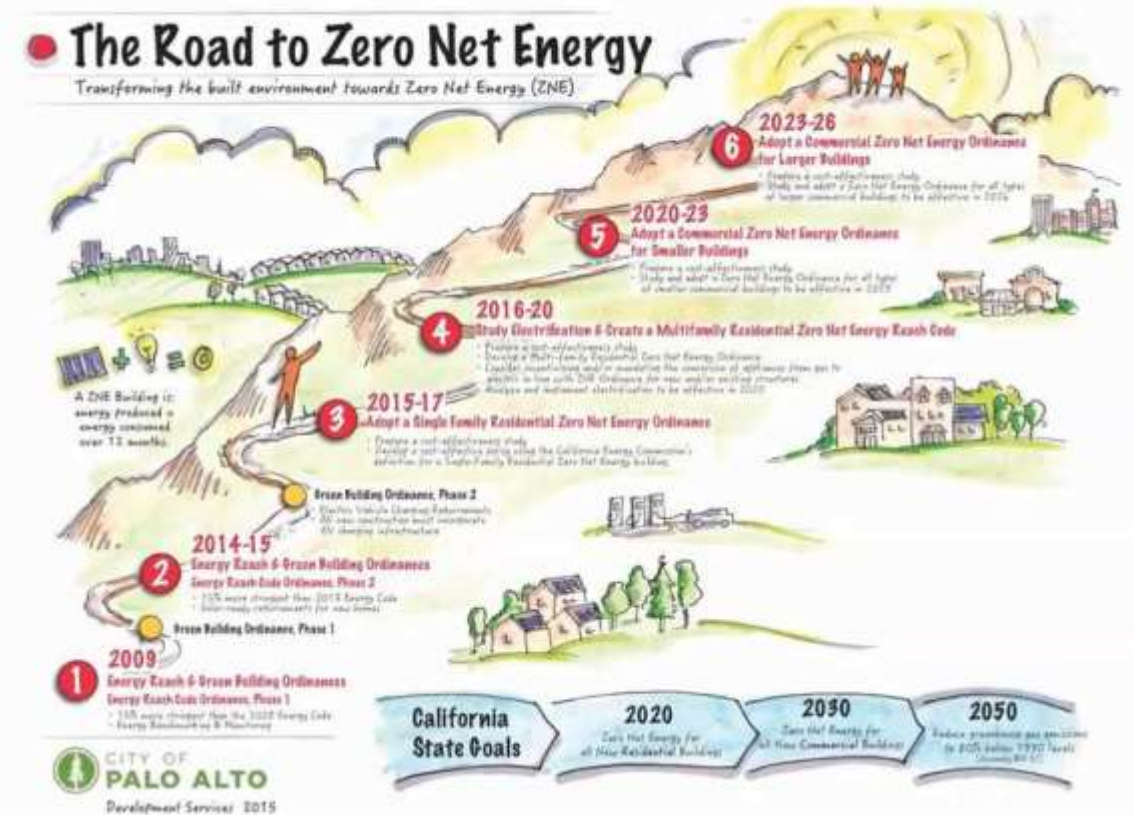
The City of Toronto Zero Emissions Buildings Framework



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.

Figure 6. Palo Alto Roadmap to Exceeding State of California ZNE Targets

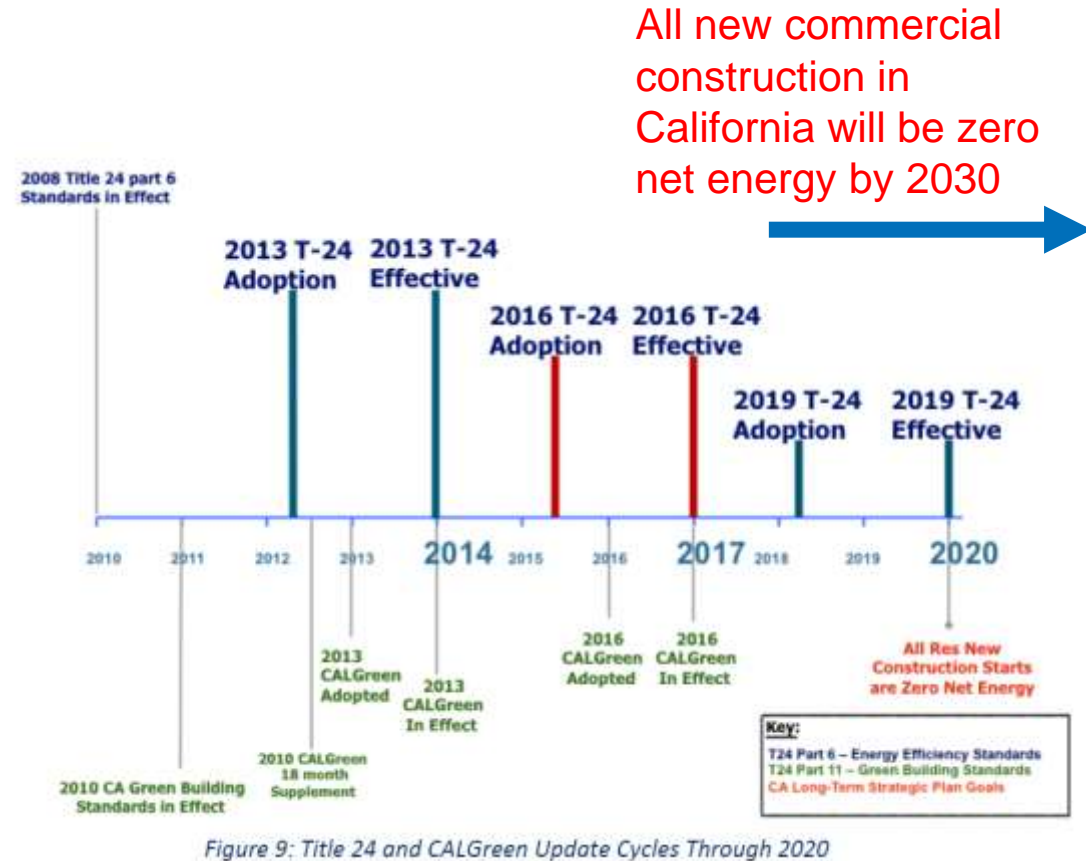


Buildings Baseline Study and Roadmap for Zero Net Energy Buildings

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)



Zero Energy Building (*NBI Getting to Zero*)

A Zero Energy (ZE) building* is highly energy efficient and meets $\geq 100\%$ 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 or 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.



Marin Country Day School (Photo: Michael David Rose)

**Also known as Net Zero Energy (NZE), or Zero Net Energy (ZNE). Zero Energy Building (ZEB)*

Four Foundations to Support Zero Carbon Building Policies

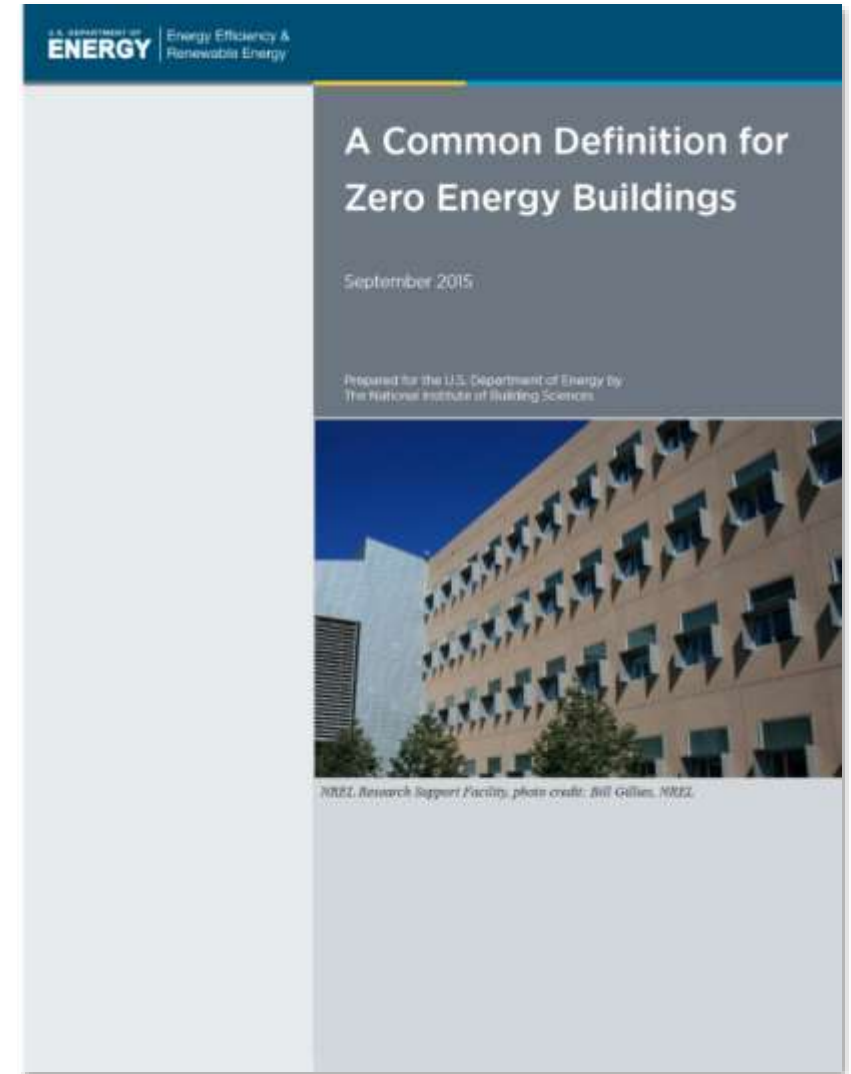


- ✓ Energy Efficiency – makes each of the other 3 foundations more achievable
- ✓ Renewable Energy Sources – onsite generation and offsite procurement
- ✓ Building / Grid Integration - account for and manage impacts on energy supply grids
- ✓ Building Decarbonization and Electrification – reduction/elimination 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



WORLD GREEN BUILDING COUNCIL

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

2050

2030

All new buildings must operate at net zero carbon

GOVERNMENT ENGAGEMENT

TRAINING & EDUCATION

CORPORATE ENGAGEMENT

CERTIFICATION

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



Zero Energy
Building Definitions
and Policy Activity

An International Review

IPEEC Building Energy Efficiency Taskgroup

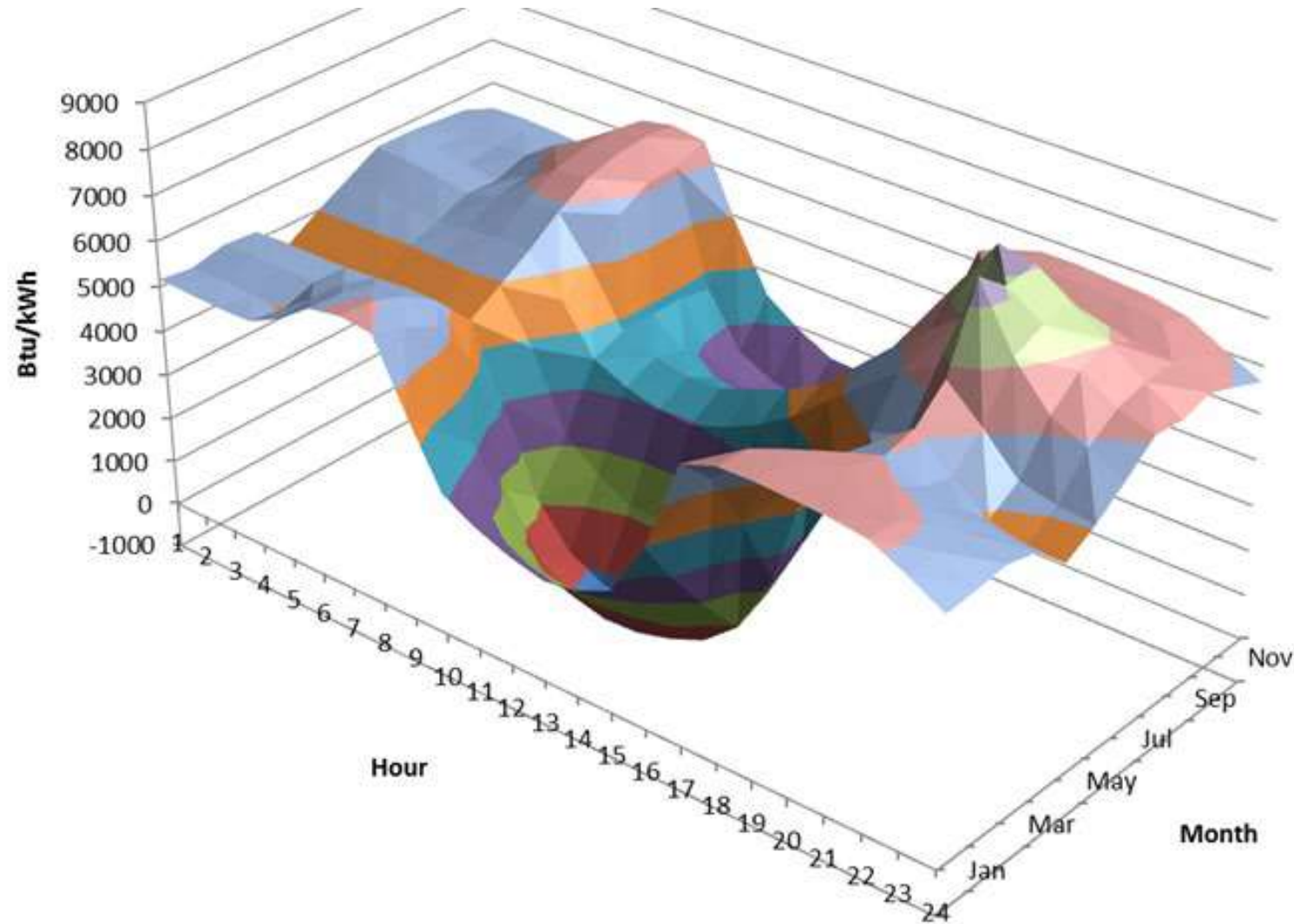


- Prepared Summer 2018 for the International Partnership for Energy Efficiency Cooperation (IPEEC)
- Reviews International ZE Related Definitions and Policy Activity

Available at:

https://ipeec.org/upload/publication_related_language/pdf/766.pdf

Time-Dependent Source Energy (California, Eley)



Zero Energy Residential Appendix - 2021 IECC (D)

TABLE RB103.2
MAXIMUM ENERGY RATING INDEX ^a

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

^a 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*.

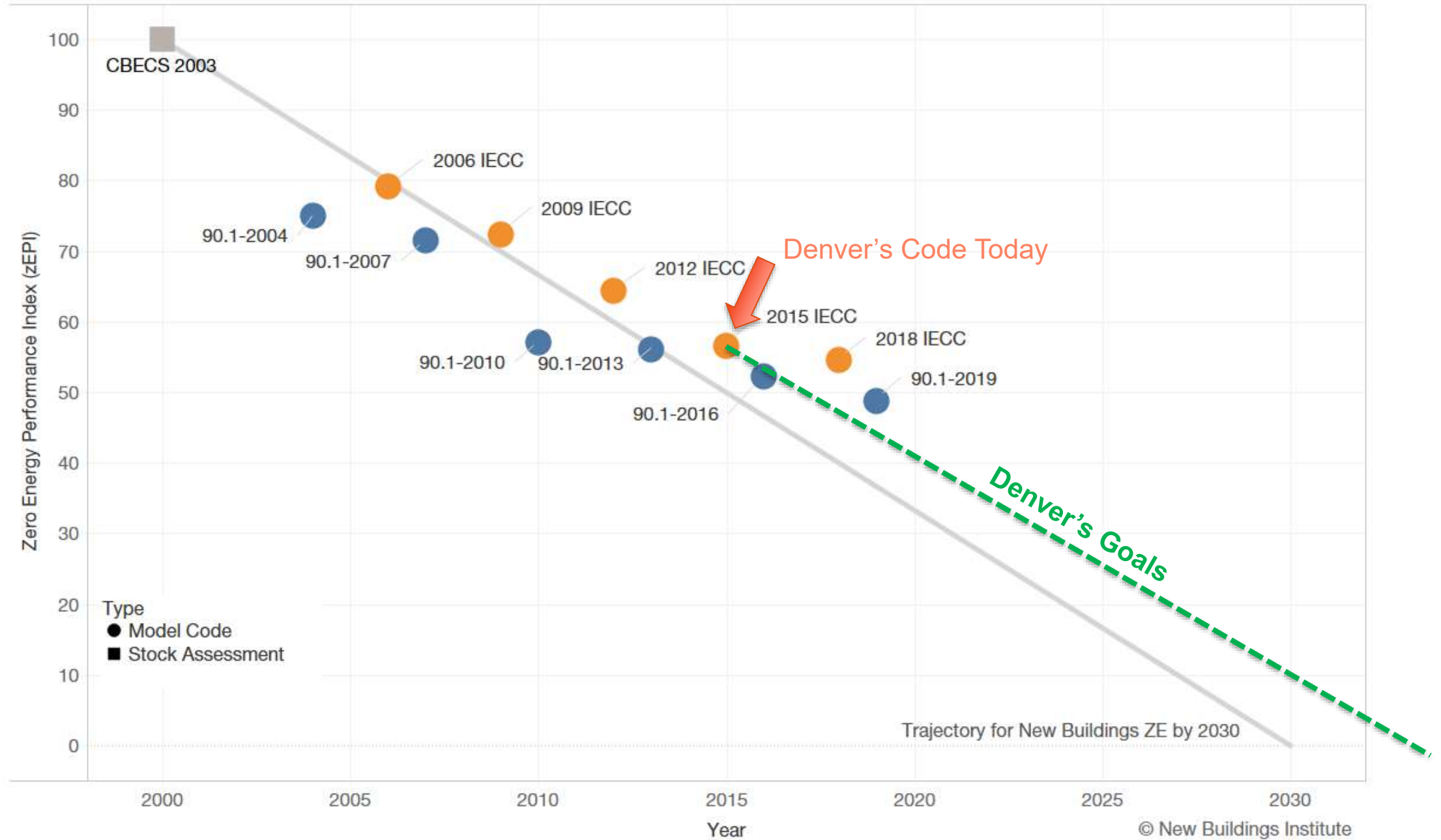
Other Zero Codes/Policies

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

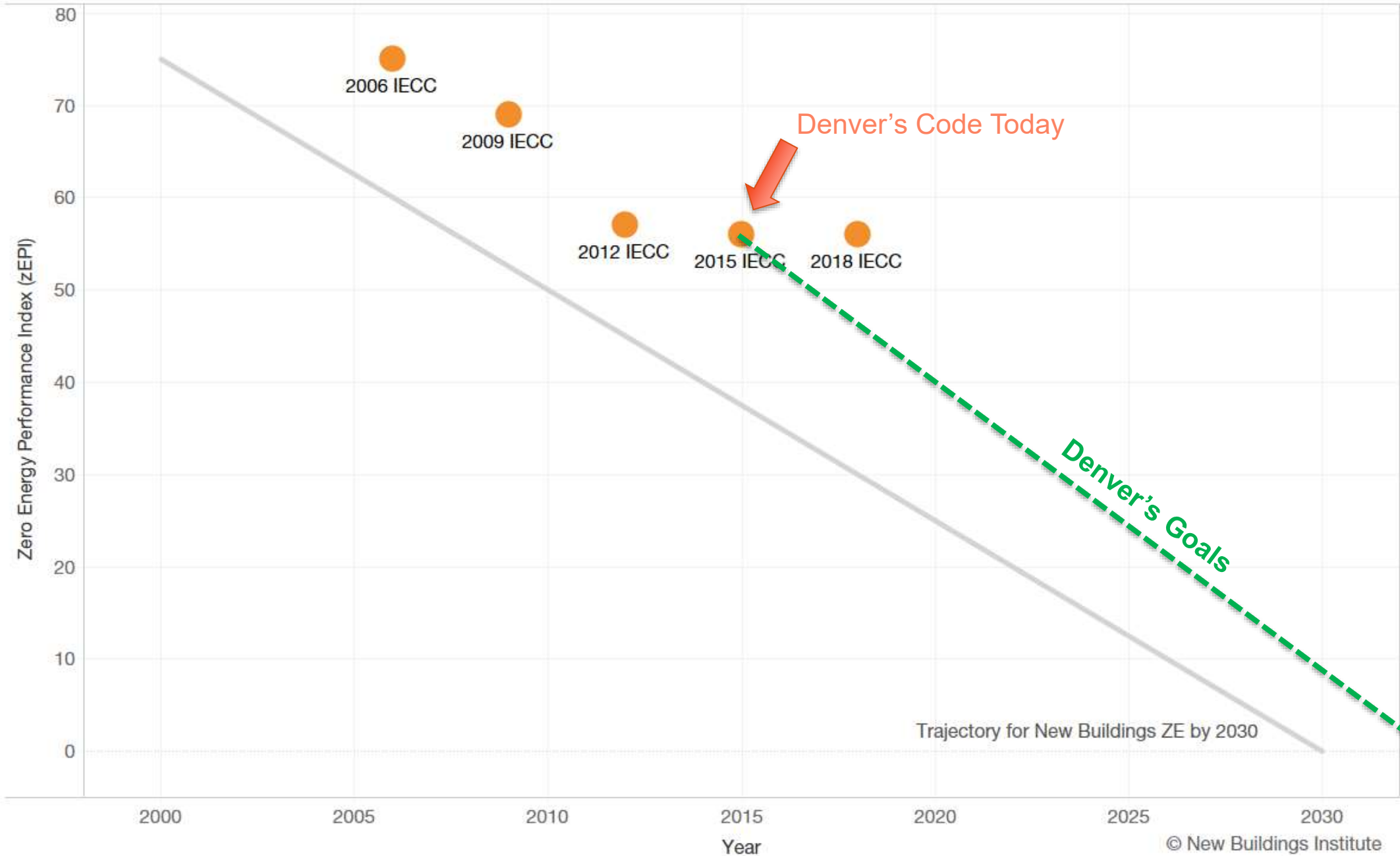
Net Zero New Construction by 2035

US DOE Codes Conference – Denver CO

Denver's Path To Net Zero Energy – Commercial



Denver's Path To Net Zero Energy – Residential



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 equiv. 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

Week of	Mon.	Tues.	Wed.	Thurs.
April 15 -Orientation		IFC-SC	M/P/Fg	IECC
April 22 - Orientation	IGCC	IFC	IRC	IBC/IEBC
April 29	– no meetings –			
May 6	– no meetings –			
May 13		IFC-SC	M/P/Fg	IECC
May 20	IGCC	IFC	IRC	IBC/IEBC
May 27		IFC-SC	M/P/Fg	IECC
June 3	– no meetings –			
June 10	IGCC	IFC	IRC	IBC/IEBC
June 17		IFC-SC	M/P/Fg	IECC
June 24	– no meetings –			
July 1	IGCC	IFC	IRC	<i>July 4 – MTG. MOVED TO MON.*</i>
July 8	<i>*IBC/IEBC</i>	IFC-SC	M/P/Fg	IECC
July 15	– no meetings –			
July 22	IGCC	IFC	IRC	IBC/IEBC
July 29		IFC-SC	M/P/Fg	IECC
August 5	IGCC	IFC	IRC	IBC/IEBC

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 Efficiency
Mechanical Penetrations
Parking Lot Lighting
Thermal Bridging
Energy recovery ventilation
Staged air volume - RTU's



Cincinnati Police Station , Cincinnati, OH | Credit: Darrin Hunter, Dish Design LLC

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Thank you

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