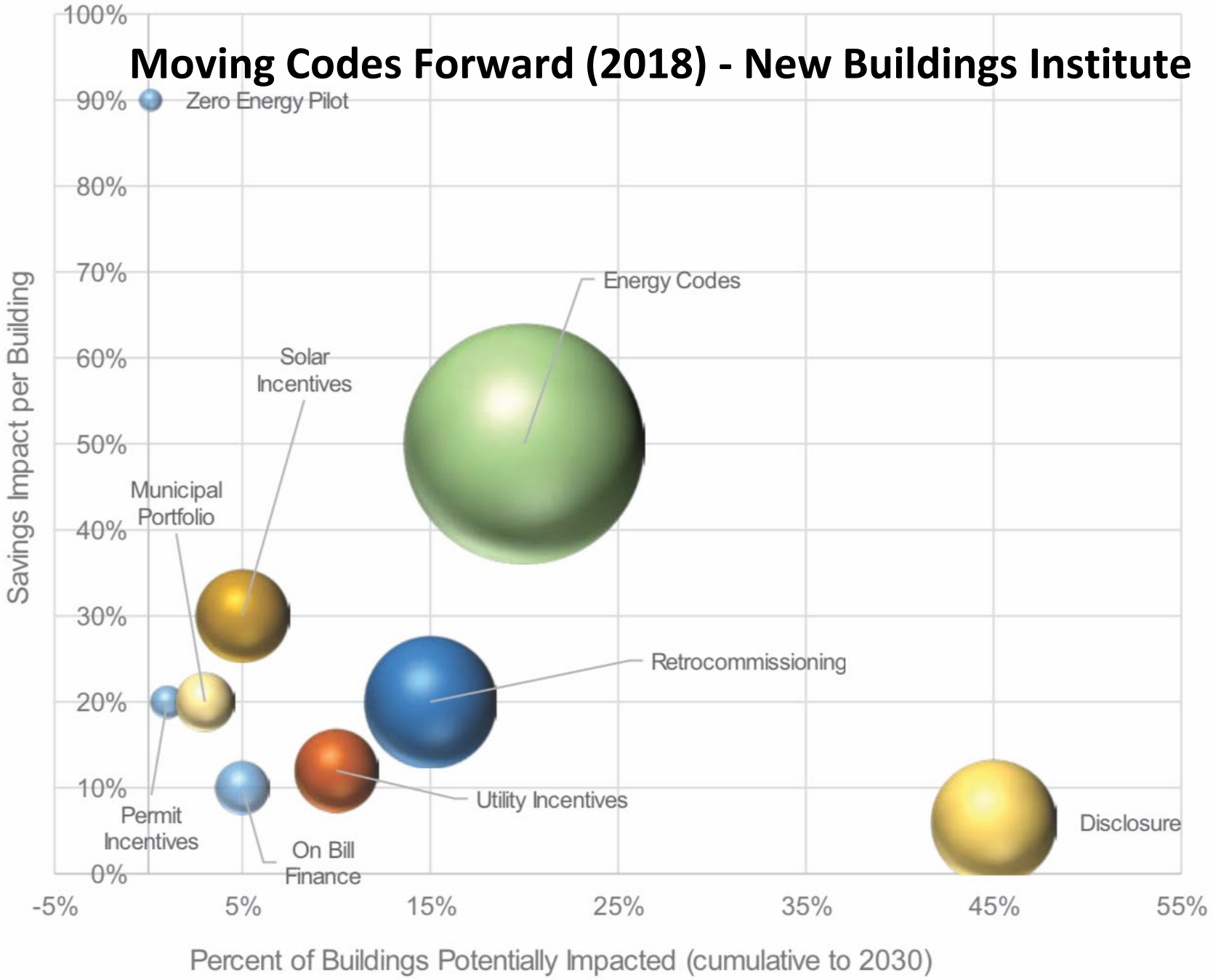
Buildings, Efficiency and Performance

Richard Graves, FAIA - Director, Center for Sustainable Building Research, University of Minnesota - rmgraves@umn.edu

Moving Codes Forward (2018) - New Buildings Institute



zEPI* Scale to ZNE

National Milestones

CBECS 2003 Average* — 100

ASHRAE 90.1-2004 — 73

ASHRAE 90.1-2010 — 57

ASHRAE 90.1-2013 — 52

IgCC-2015 (Chapter 6) — 50

Massachusetts Stretch Code (47)

NBI 20% Stretch Code (42)

Arch 2030 Goal - 2010 — 40

NBI 40% Reach Code (31)

Arch 2030 Goal - 2015 — 30

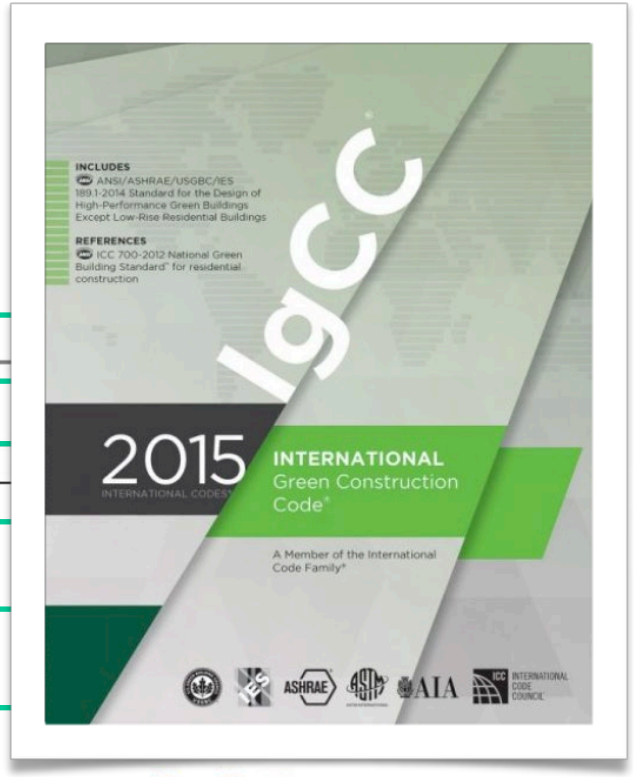
Arch 2030 Goal - 2020 — 20

Arch 2030 Goal - 2025 — 10

Zero Net Energy — 0

Policies and Projects

Average Performance of United States's Building Stock in the Year 2000



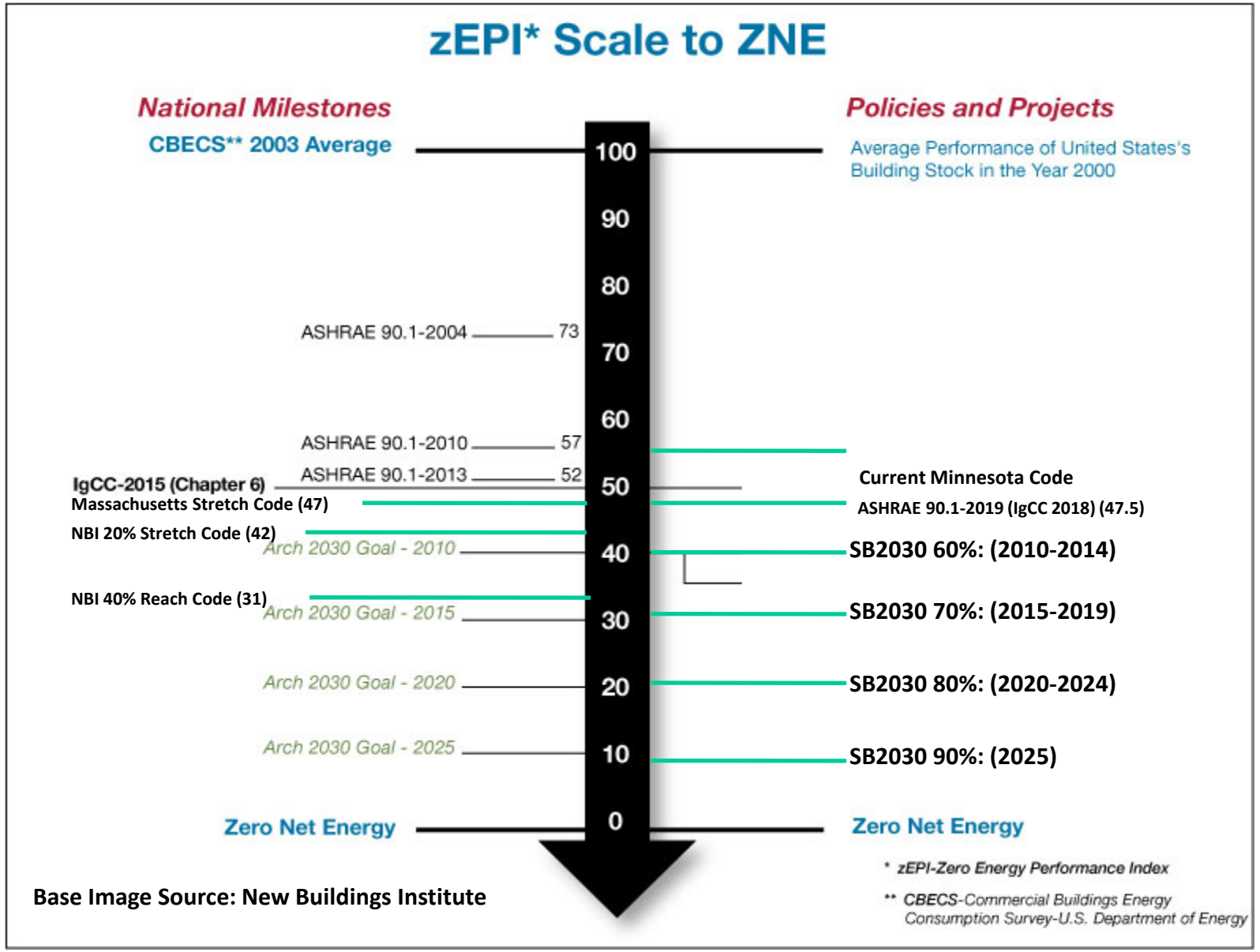
Zero Net Energy

* *zEPI-Zero Energy Performance Index*

** *CBECS-Commercial Buildings Energy Consumption Survey-U.S. Department of Energy*

Base Image Source: New Buildings Institute

Richard Graves
rmgraves@umn.edu



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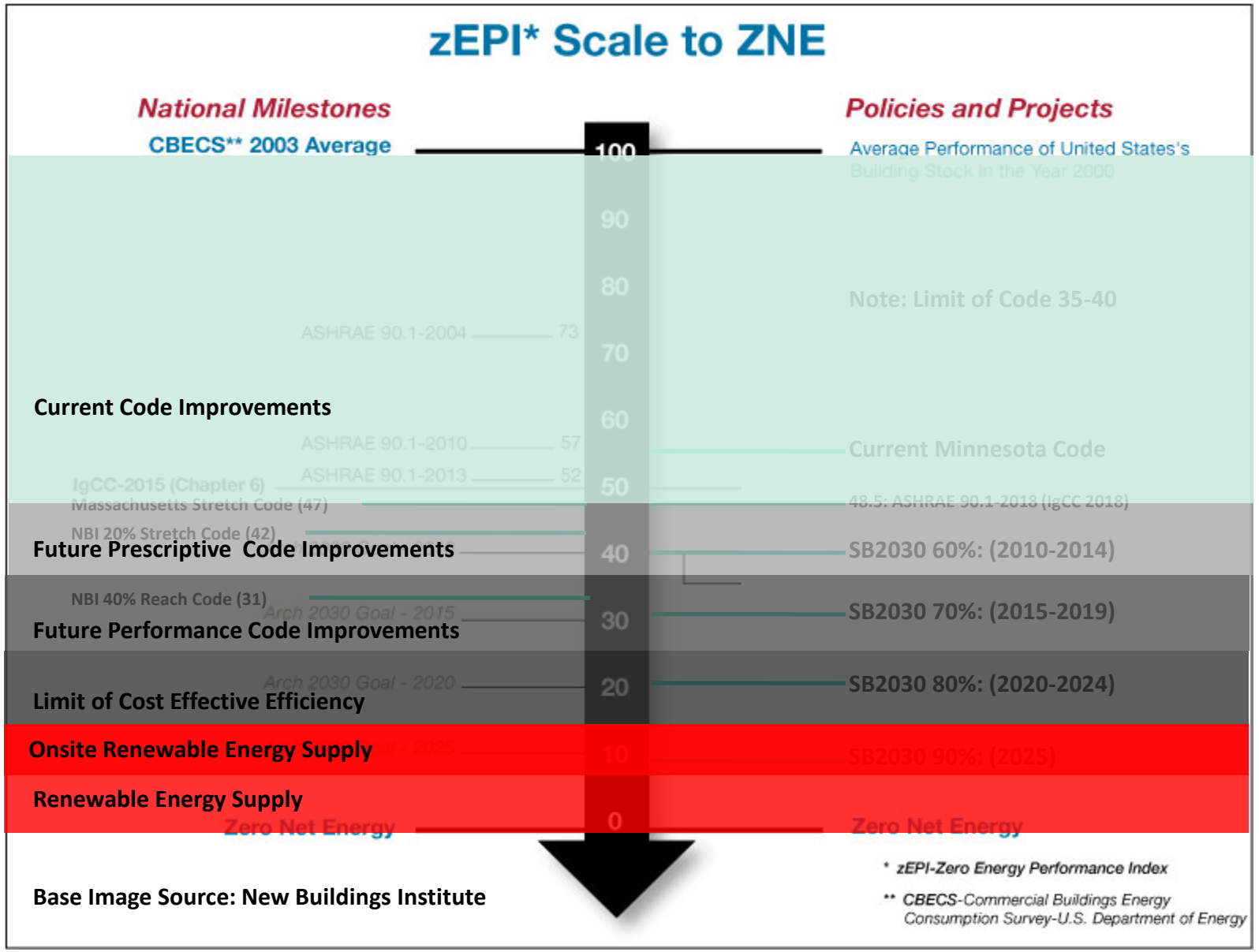
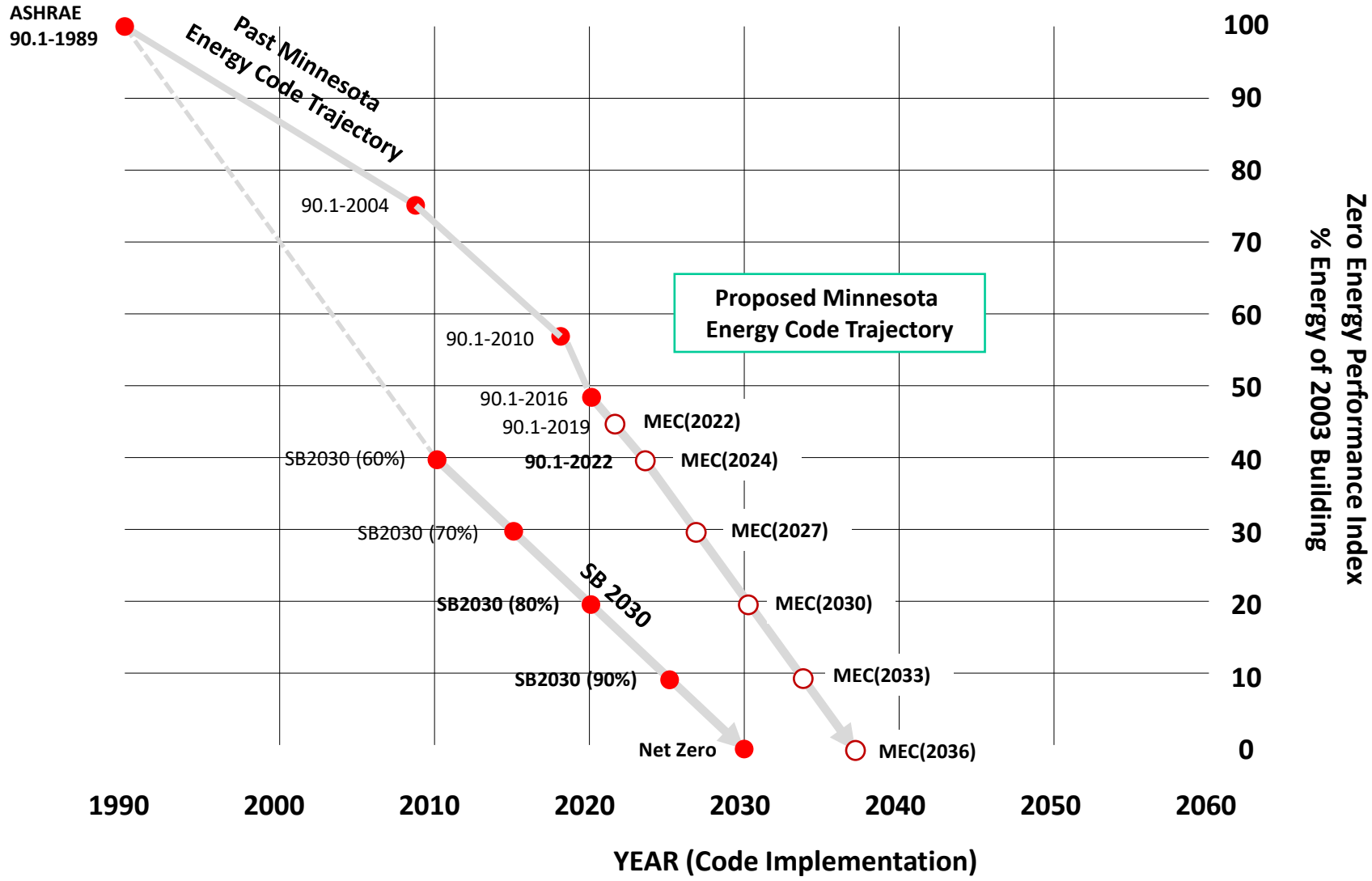
zEPI* Scale to ZNE

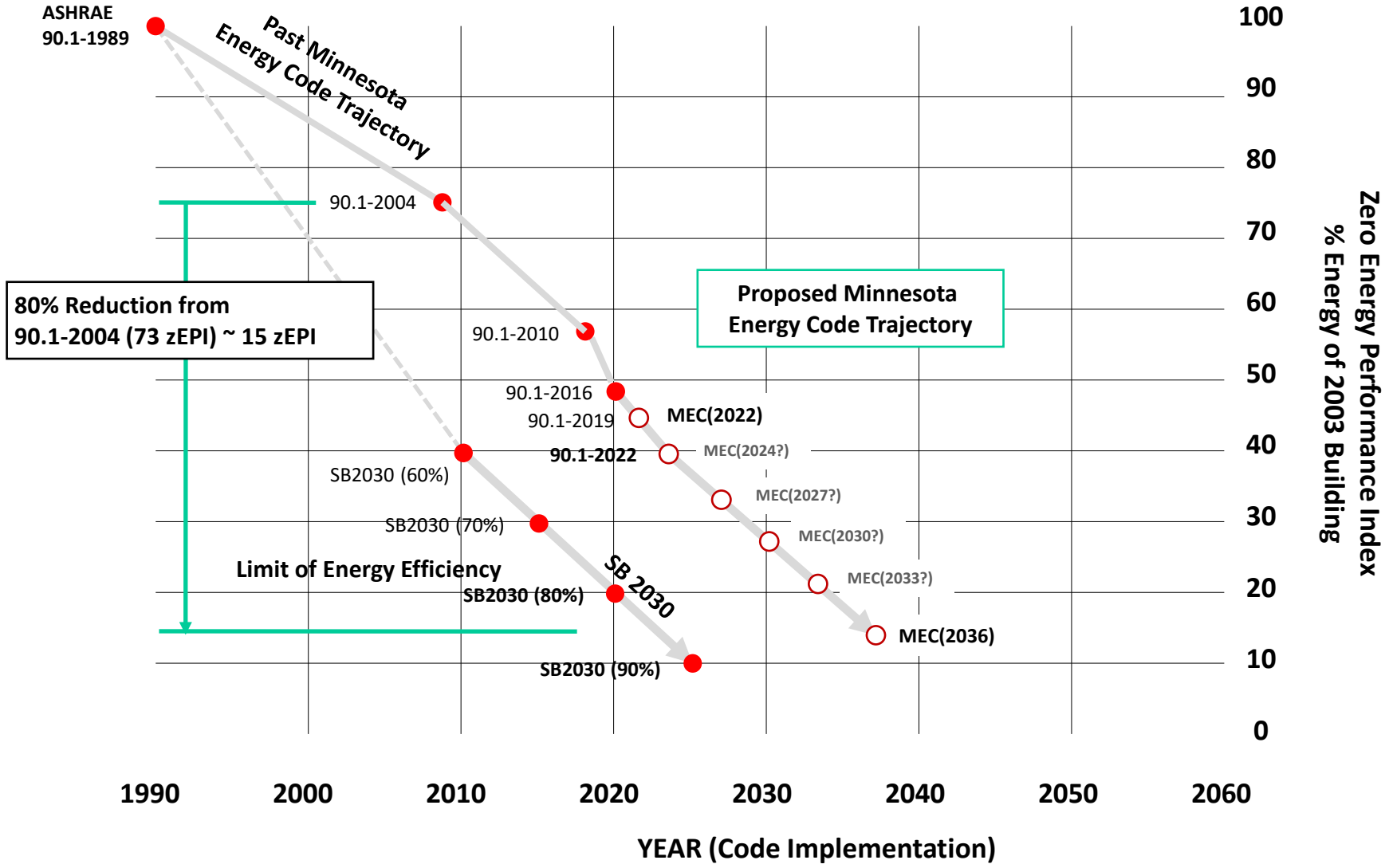


Proposed Minnesota Energy Code Trajectory (2020 Report)



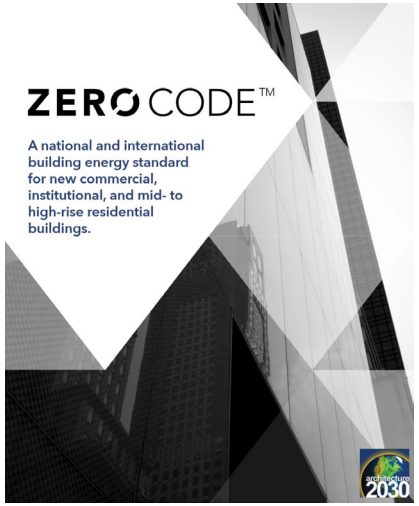
Based upon zEPI: Zero Performance Index for Energy Codes from the New Buildings Institute

HF772-2023 Minnesota Energy Code Trajectory

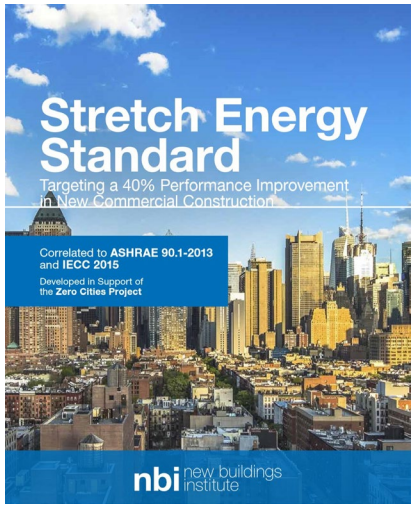


Based upon zEPI: Zero Performance Index for Energy Codes from the New Buildings Institute

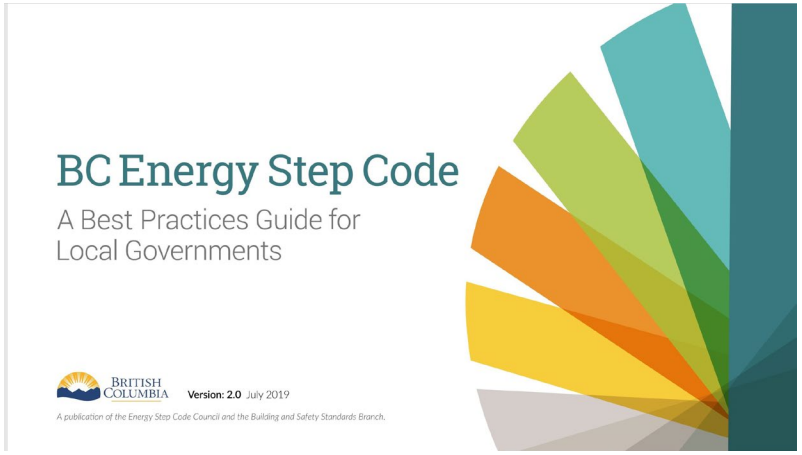
Other Programs



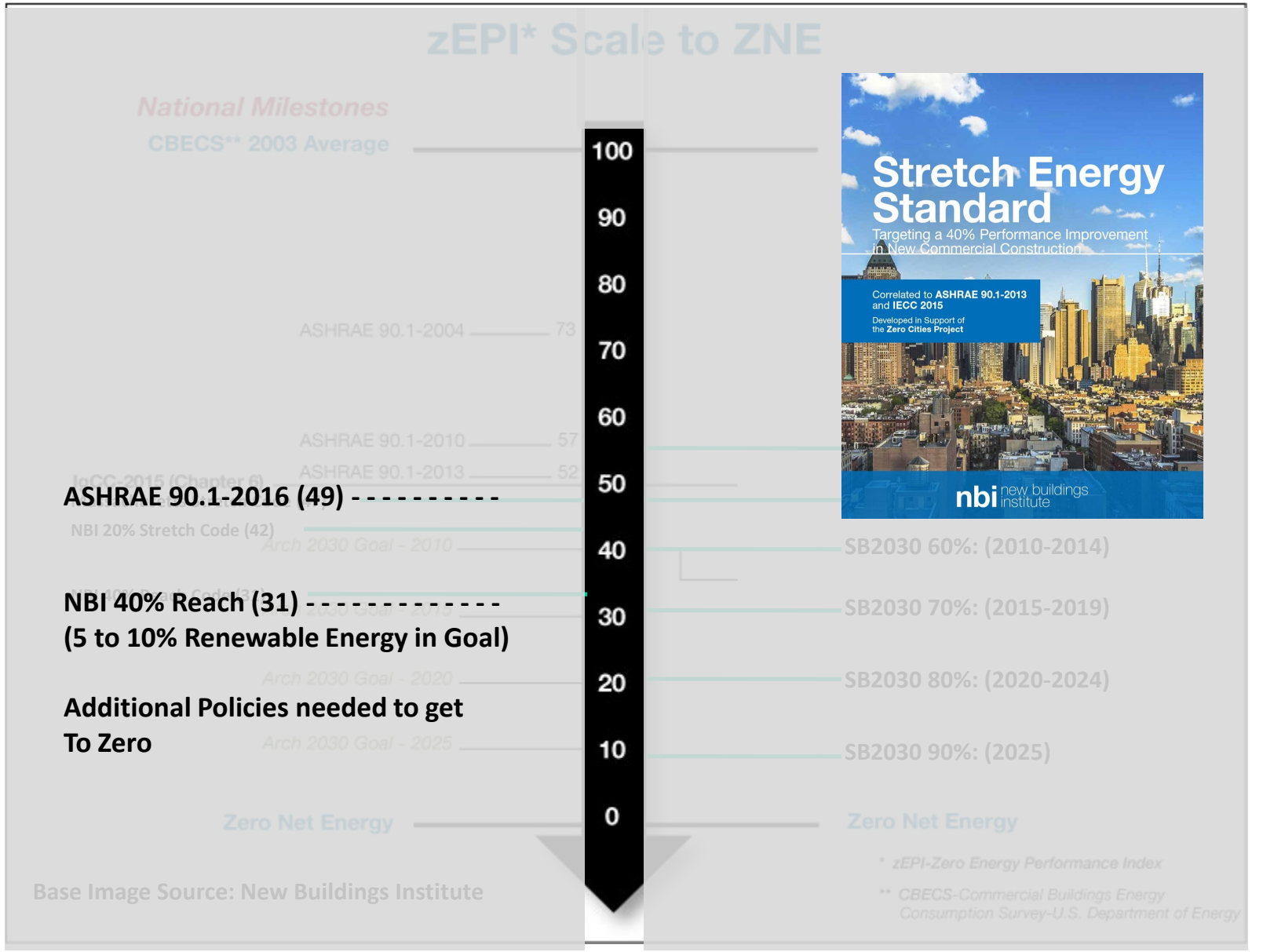
Architecture 2030 : Zero Code

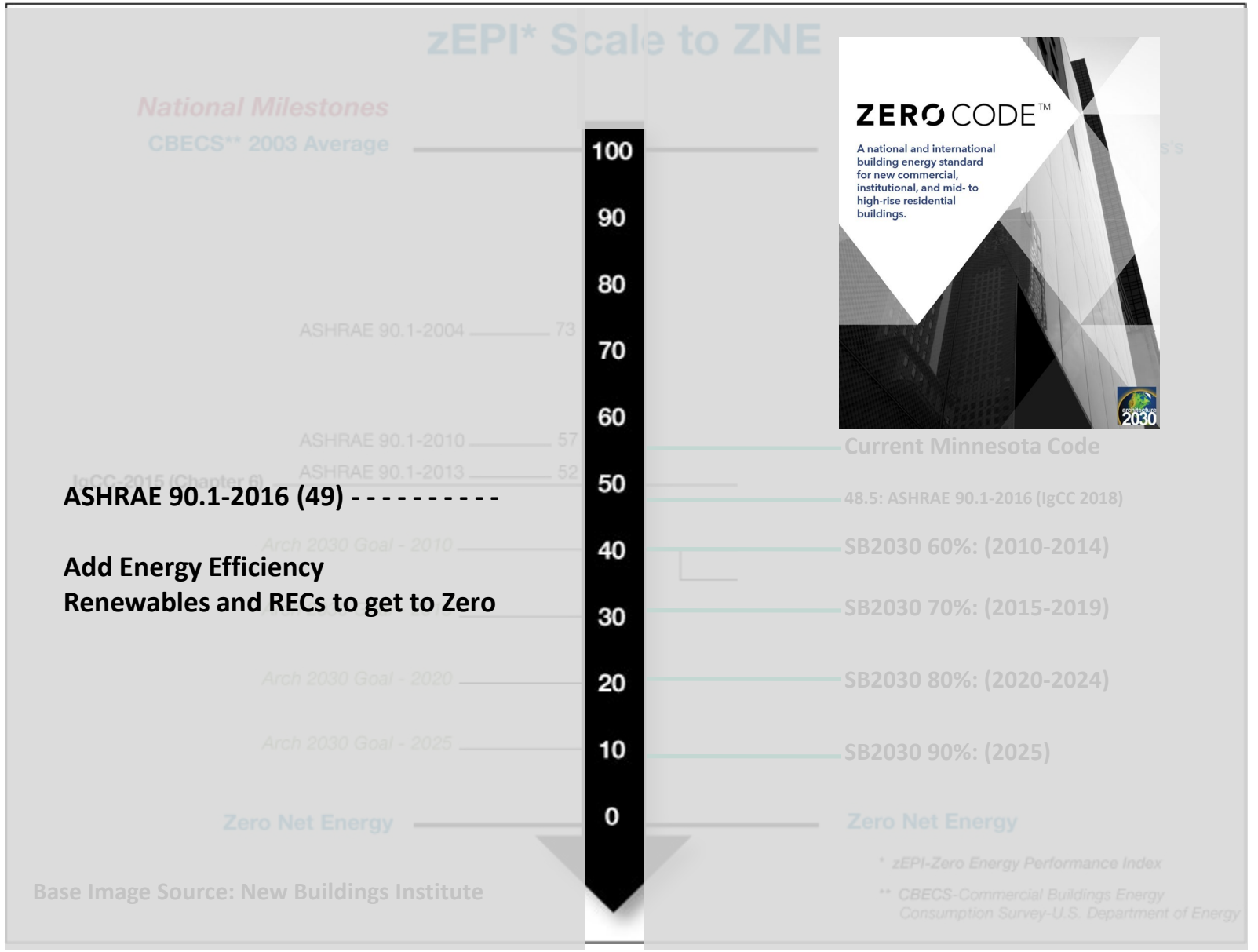


New Buildings Institute: 40% Reach Standard



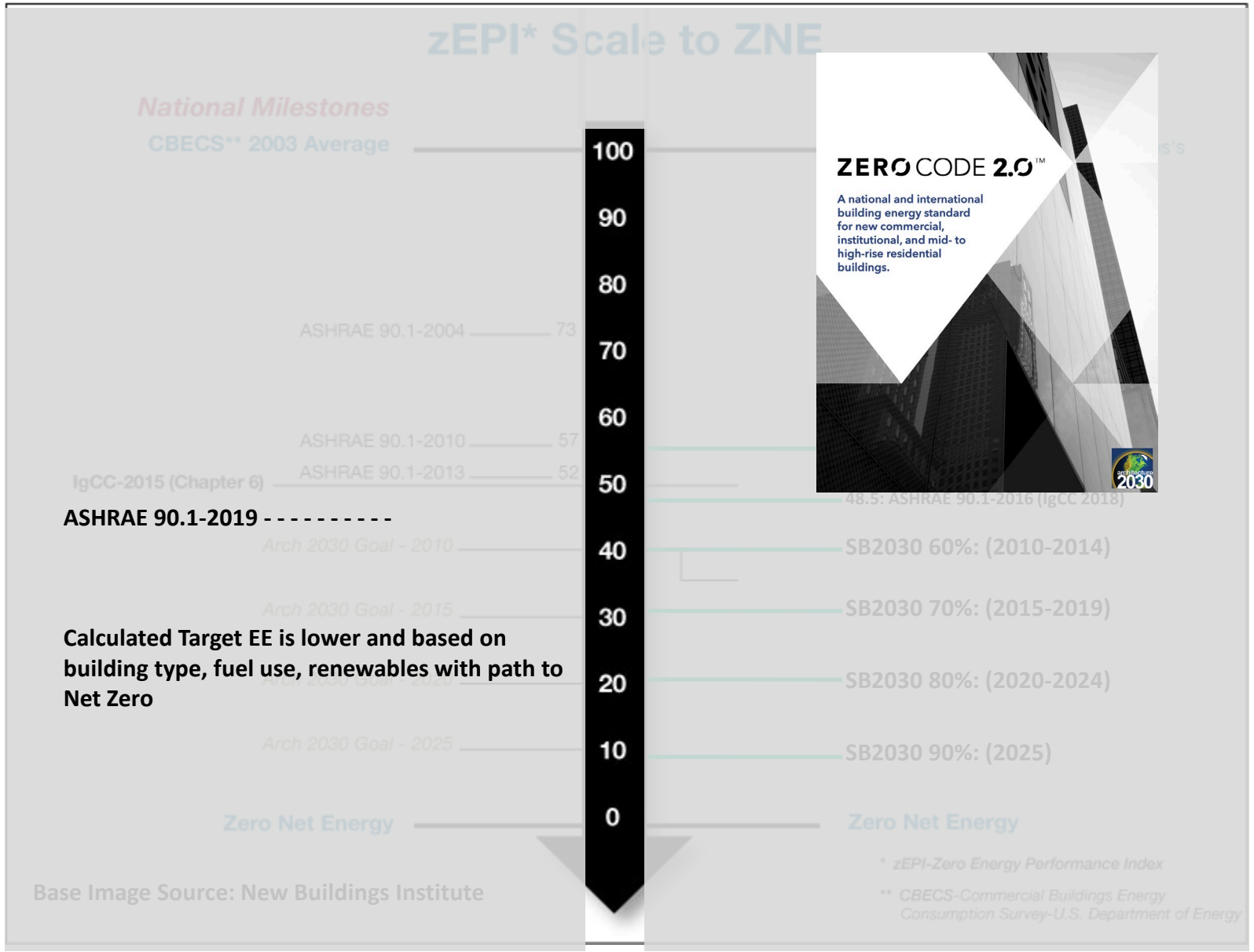
British Columbia: Step Code


zEPI* Scale to ZNE
National Milestones
CBECS** 2003 Average
ASHRAE 90.1-2004
73
ASHRAE 90.1-2010
57
ASHRAE 90.1-2013
52
IgCC-2015 (Chapter 6)
NBI 20% Stretch Code (42)
Arch 2030 Goal - 2010
Arch 2030 Goal - 2020
Arch 2030 Goal - 2025
Zero Net Energy
100
90
80
70
60
50
40
30
20
10
0
ASHRAE 90.1-2016 (49) - - - - - - - - - -
NBI 40% Reach (31) - - - - - - - - - - - - -
(5 to 10% Renewable Energy in Goal)
Additional Policies needed to get
To Zero
Stretch Energy Standard
Targeting a 40% Performance Improvement in New Commercial Construction
Correlated to ASHRAE 90.1-2013 and IECC 2015
Developed in Support of the Zero Cities Project
nbi new buildings institute
SB2030 60%: (2010-2014)
SB2030 70%: (2015-2019)
SB2030 80%: (2020-2024)
SB2030 90%: (2025)
Zero Net Energy
* zEPI-Zero Energy Performance Index
** CBECS-Commercial Buildings Energy Consumption Survey-U.S. Department of Energy
Base Image Source: New Buildings Institute



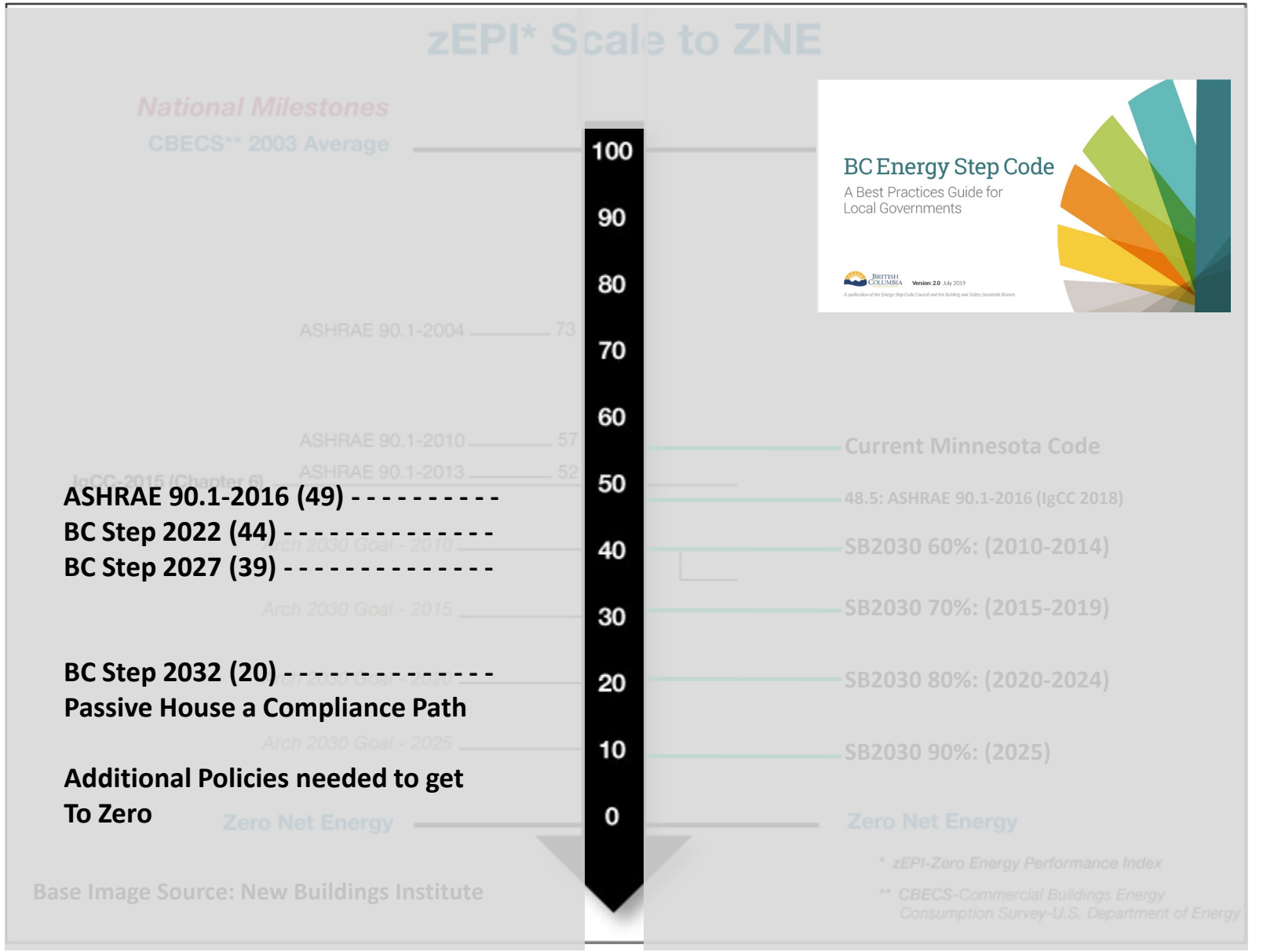
ASHRAE 90.1-2016 (49) - - - - - - - - - -

Add Energy Efficiency
Renewables and RECs to get to Zero



ASHRAE 90.1-2019 - - - - - - - - - -

Calculated Target EE is lower and based on building type, fuel use, renewables with path to Net Zero


zEPI* Scale to ZNE
National Milestones
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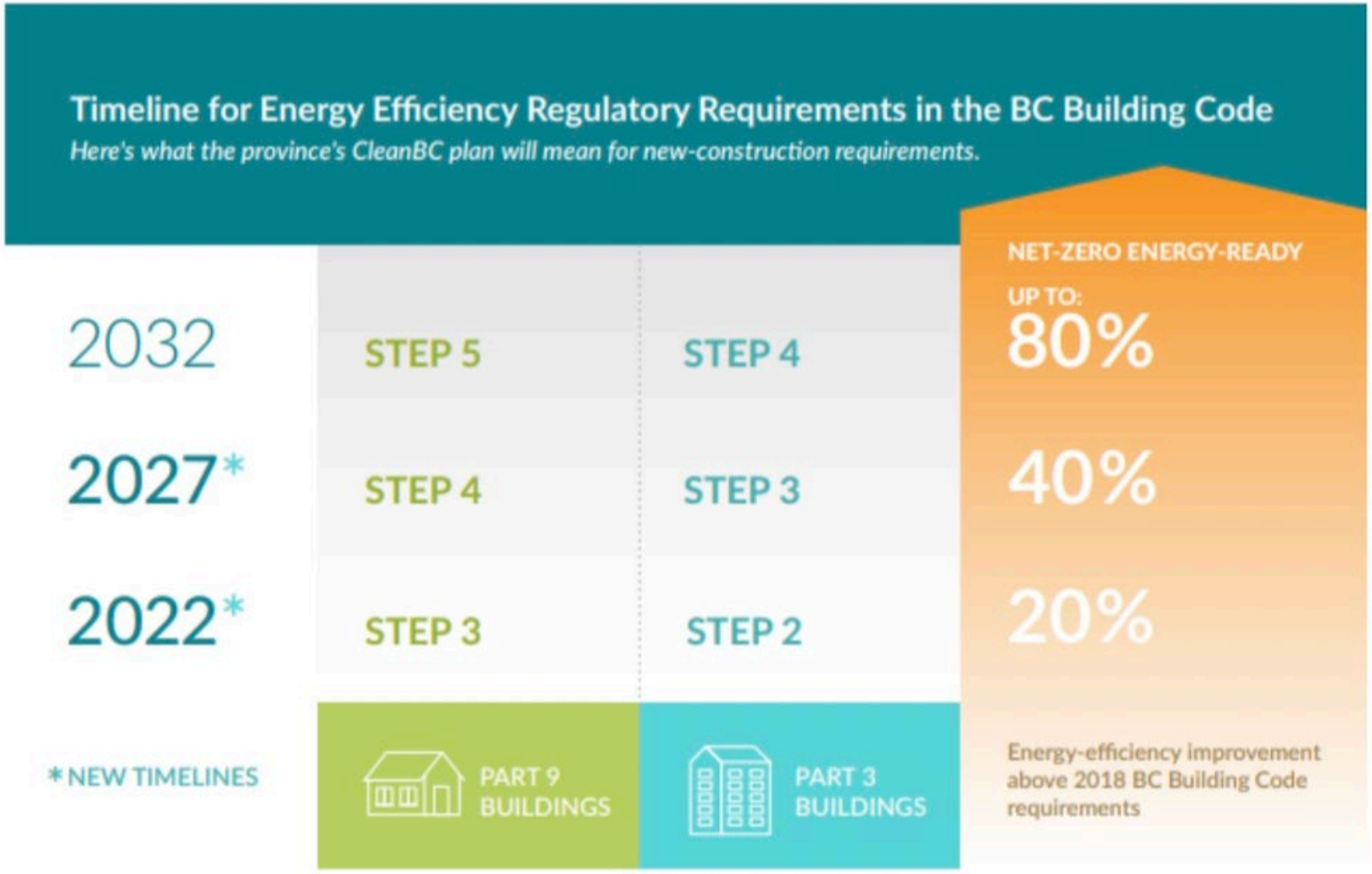
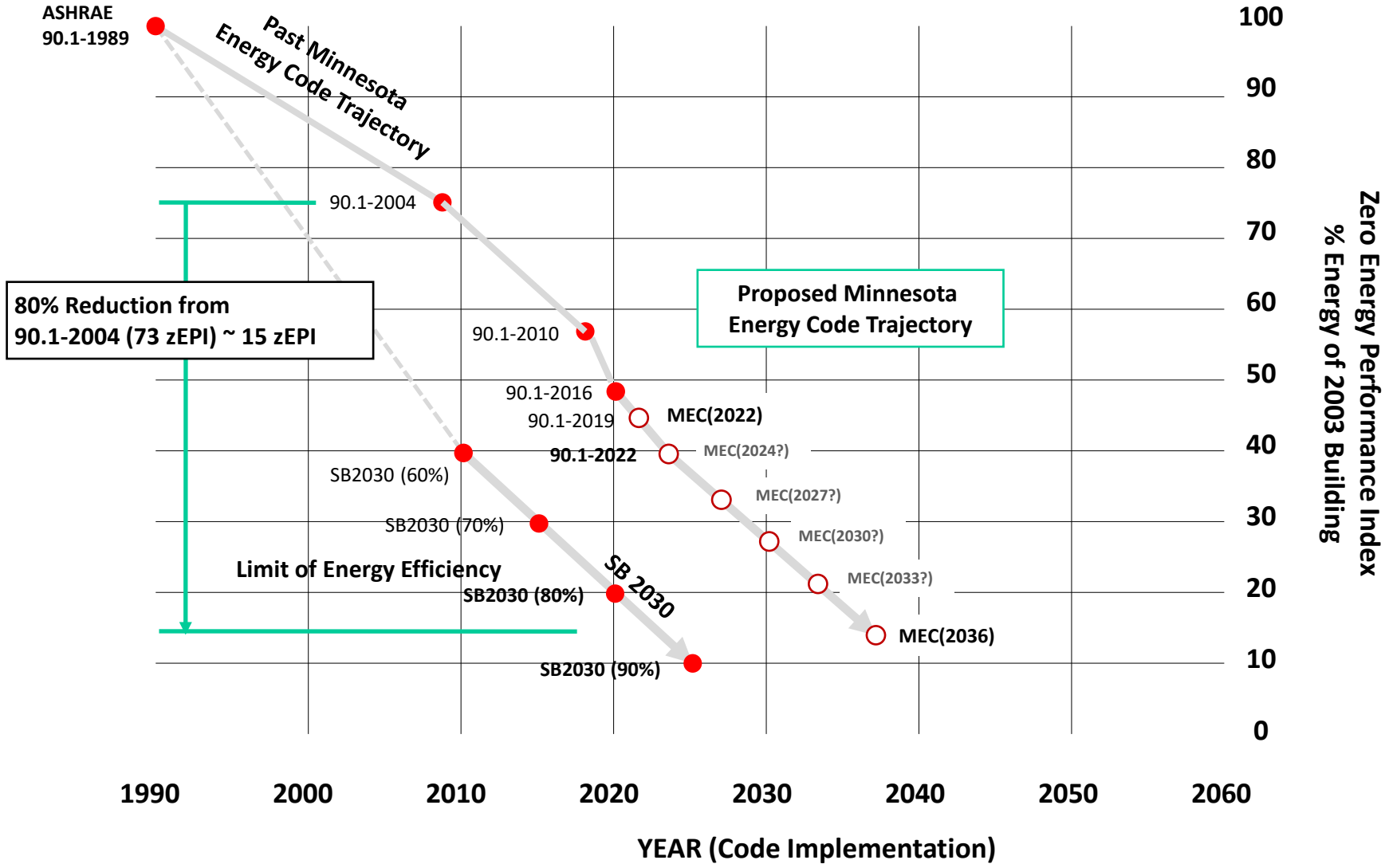
20
Arch 2030 Goal - 2025
10
Zero Net Energy
0
BC Energy Step Code
A Best Practices Guide for Local Governments
BRITISH COLUMBIA
Version: 2.0 July 2019
Current Minnesota Code
48.5: ASHRAE 90.1-2016 (IgCC 2018)
SB2030 60%: (2010-2014)
SB2030 70%: (2015-2019)
SB2030 80%: (2020-2024)
SB2030 90%: (2025)
Zero Net Energy
ASHRAE 90.1-2016 (49) - - - - - - - - - -
BC Step 2022 (44) - - - - - - - - - - - - -
BC Step 2027 (39) - - - - - - - - - - - - -
BC Step 2032 (20) - - - - - - - - - - - - -
Passive House a Compliance Path
Additional Policies needed to get
To Zero
Base Image Source: New Buildings Institute
* zEPI-Zero Energy Performance Index
** CBECS-Commercial Buildings Energy Consumption Survey-U.S. Department of Energy

British Columbia Step Code

British Columbia Step Code



HF772-2023 Minnesota Energy Code Trajectory



Based upon zEPI: Zero Performance Index for Energy Codes from the New Buildings Institute

ENERGY STEPCODE
BUILDING BEYOND THE STANDARD

Search ... Search

LEARN | CODE AND COMPLIANCE TOOLS | RESOURCES A TO Z | EVENTS | ABOUT

Resources A to Z

- ALL RESOURCES
- ADOPTION BY LOCAL GOVERNMENTS
- BUILDER GUIDES AND HANDBOOKS
- BULLETINS
- CASE STUDIES
- ENERGY ADVISORS
- ENERGY MODELLING
- IMPLEMENTATION TOOLS
- INCENTIVE PROGRAMS
- INDUSTRY RESOURCES
- LOCAL GOVERNMENT RESOURCES
- NORTHERN AND RURAL RESOURCES
- REPORTS
- TRAINING OPPORTUNITIES
- VIDEOS

NEW MILESTONE FOR CLEANER, MORE ENERGY EFFICIENT BUIL

As of May 1, 2023, the BC Building Code (the Code) requires 20%-better energy efficiency for most new buildings s for Part 9 buildings and Step 2 for Part 3 buildings. A new Zero Carbon Step Code provides tools to local governments ew construction. This is a significant milestone in B.C.'s transition towards energy efficient and zero carbon new bui le for local government opt-in. This website will be further updated to reflect these changes. Learn more about th .

THE ENERGY STEP CODE CO

The Energy Step Code Council, ar governments and industry as both to work. It serves as a "bridge" be to identify and resolve implement resources, and ensure local gover Learn more about the Council.

Code utilities, ly.

Health and Comfort

Studies have shown that high-performance homes are more comfortable and healthier, because they effectively manage temperature and fresh air throughout the building.

Climate Leadership

The BC Energy Step Code puts British Columbia on a path to meet the province's target that all new buildings must be "net-zero energy ready" by 2032.

Jobs and Economy

The BC Energy Step Code could open up new opportunities for B.C. in the growing global market for energy efficiency education, technology, and services.

Less Energy, Lower Bills

The BC Energy Step Code improves energy efficiency and lowers energy bills compared to homes and buildings with similar systems designed under the BC Building Code.

PUTTING THE FOCUS ON PERFORMANCE

The BC Energy Step Code sets performance requirements for new construction and groups them into "steps." All authorities having jurisdiction over the BC Building Code—including local governments—can choose to require or incentivize builders to meet one or more steps of the BC Energy Step Code as an alternative to the code's prescriptive requirements. Learn more about the steps...

Advance Commercial Codes Policy

Katie Jones - Sr. Manager, Community Energy Policy

Nov. 1, 2023

cee
Center for Energy and Environment

CEE's nonprofit

PROGRAMS

We cut energy waste and improve comfort in homes, buildings, and communities.

RESEARCH

We identify cost-effective, efficient technologies through analysis, modeling, and engagement.

CONSULTING

We help building owners and entire communities achieve long-term, energy-saving solutions.

LENDING

We empower people to make upgrades on energy efficiency and comfort in homes or businesses.

POLICY

We strive for high-impact, pragmatic solutions guided by a public interest ethic.

MARKET TRANSFORMATION

We accelerate adoption of promising technologies through early market engagement.

cee
Center for Energy and Environment

Years of stakeholder engagement

2019

Engagement workshop series to discuss advancing commercial cod included cities, labor, building officials, regulators, utilities, and more.

2020

DLI/Commerce white paper in 2020

2021–2022

Conversations continued in 2021-2022, but a major challenge emerged with the term “net zero.”

Center for Energy and Environment

Challenges with “net zero”

- Lack of clear definition
- Not all stakeholders could support the notion
- Intertwines two distinct concepts:
  - energy efficiency
  - energy generation

So, we turned focus to what stakeholders could support

Image source: https://oneseed.green/article/what-does-net-zero-mean-and-how-will-we-achieve-it--1661754437789x904739887553970200

Energy efficiency-focused code change

- Eliminates complexities of generation
- Is fuel neutral
- Aligns with what regulators are familiar with
- Maximizes technical limit of efficiency

Center for Energy and Environment

Minnesota Statutes Section 326B.106 Requirements

- “Beginning in 2024, the commissioner shall act on the new model commercial energy code by adopting each new published edition of ASHRAE 90.1 or a more efficient standard.”

- “The commercial energy code in effect in 2036 and thereafter must achieve an 80 percent reduction in annual net energy consumption or greater, using the ASHRAE 90.1-2004 as a baseline.”

- Incremental progress required between 2024-2036

Why the ASHRAE 90.1 2004 baseline?

ASHRAE IS A WIDELY ACCEPTED STANDARD

IT'S THE BASE FOR FEDERAL REQUIREMENTS.

WE COULD SHOW MAJOR PROGRESS ALREADY. (QUICK WINS HELP WITH MOMENTUM!)

Center for Energy and Environment

What about utility incentives?

"Nothing in this section shall be interpreted to limit the ability of a public utility to offer code support programs, or to claim energy savings resulting from such programs through" ECO.

Utility programs *should* be used to support efficient new construction.

Image source: https://www.3e-co.com/utility-rebates

Center for Energy and Environment

THANK YOU!

Katie Jones – kjones@mncee.org

cee
Center for Energy and Environment

Minnesota Energy Codes

Greg Metz | State Building Official

Greg.Metz@State.MN.US

Limitations of the Minnesota State Construction Codes

- Executive Branch “executes” the will of the Legislative Branch within the guidelines set by the Legislature
- Legislature limits application of codes to new construction and alterations to existing buildings
- Not retroactive
- Energy codes specific to conservation ONLY
- Building Codes form the lowest baseline

DEPARTMENT OF LABOR AND INDUSTRY

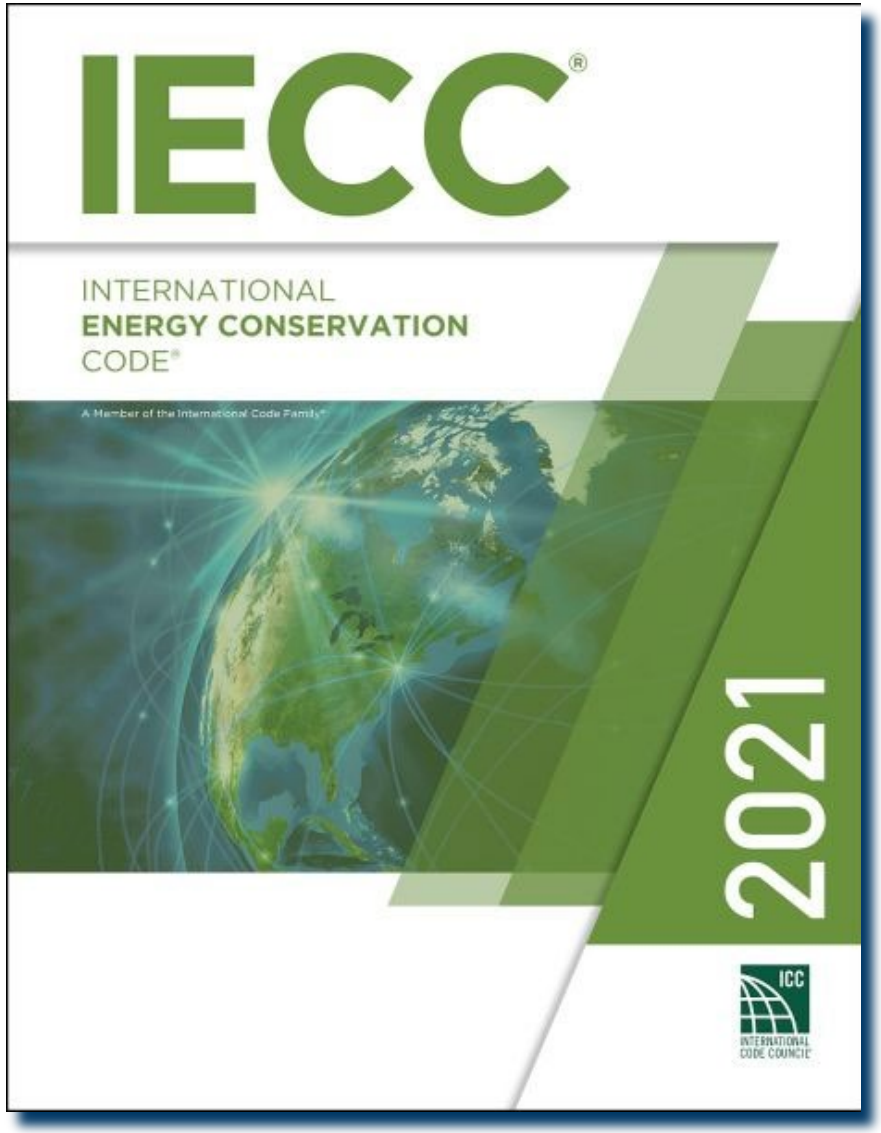
US Dept. of Energy on MN Residential Energy Code

- Current Residential Energy code uses 2012 IECC with amendments.
- Not until the 2021 IECC publishing did the model code substantially exceed MN Requirements
- US DOE issued findings in July 2021.
- DLI/CCLD initiated rulemaking in August of 2023.

DEPARTMENT OF LABOR AND INDUSTRY

MN Residential Energy Code: MN Rule 1322

- TAG Currently reviewing 2021 IECC for adoption & will consider the 2024 IECC version when released in January
- Residential Energy Code requires a Building Science Durability study prior to enforcement.
- Rulemaking + Study = 24-30 months
- Tech Advisory Group Information: https://www.dli.mn.gov/about-department/rulemaking/rulemaking-docket-minnesota-rules-chapter-1322-0



Commercial Energy Code Optimized by 2036

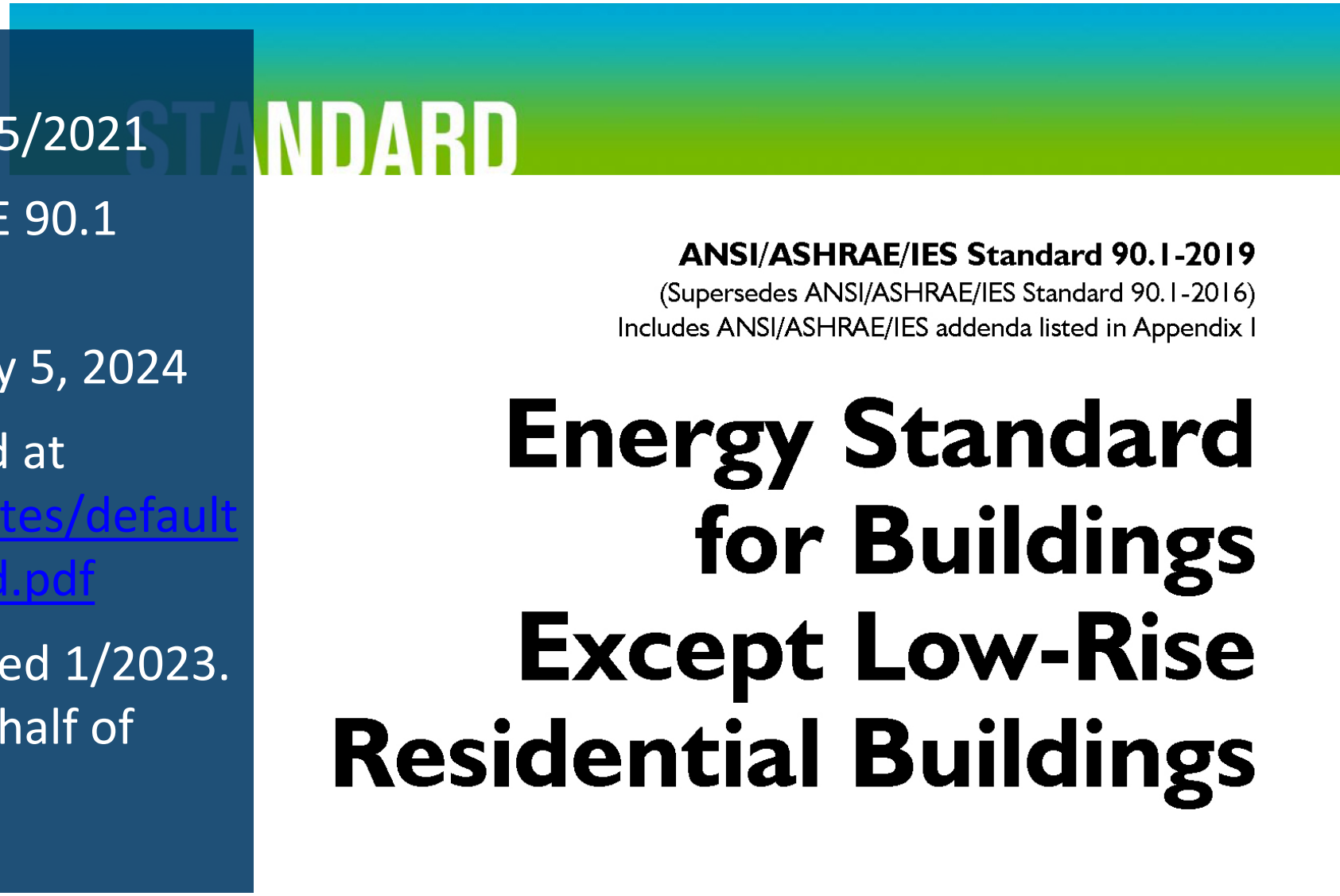
Legislative mandate to:

- Adopt each successive model commercial energy code
- Amend incrementally to increase efficiency to reach 80% greater efficiency in new construction by 2036 in comparison to 2004
- Legislative discussion included strong opposition to restricting fuel types
- Legislative discussion confirmed statutory limits of the energy code to efficiency.

DEPARTMENT OF LABOR AND INDUSTRY

MN Commercial Energy Code

- Initial TAG work started 1/5/2021
- Based on the 2019 ASHRAE 90.1 ONLY
- Enforcement starts January 5, 2024
- Amendments can be found at https://www.dli.mn.gov/sites/default/files/pdf/AR4696-adopted.pdf
- ASHRAE 90.1-2022 published 1/2023. TAG work will start in first half of 2024

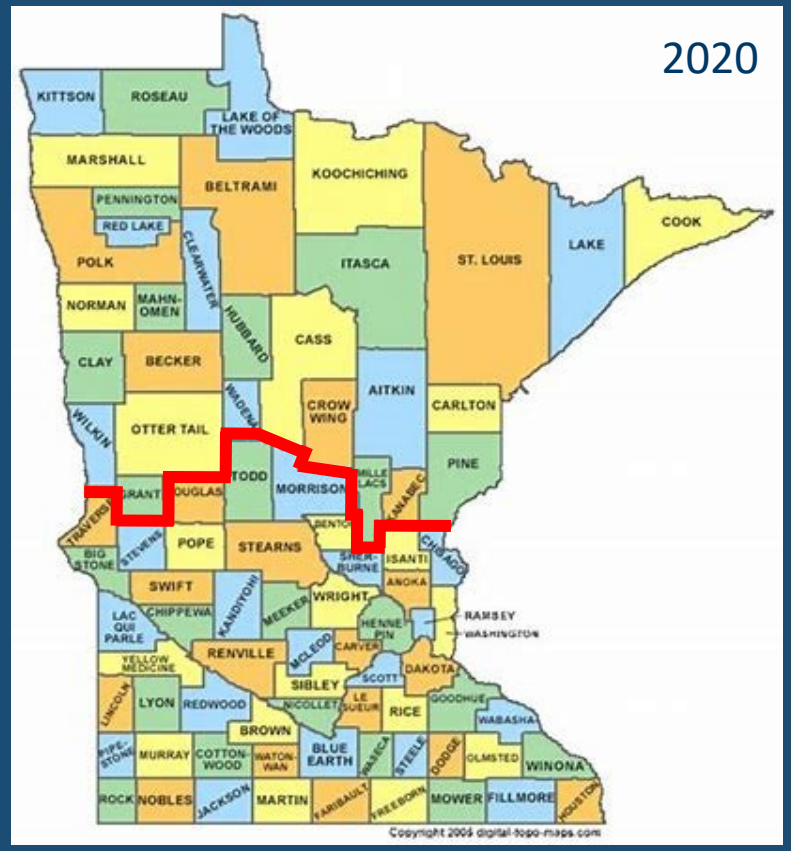


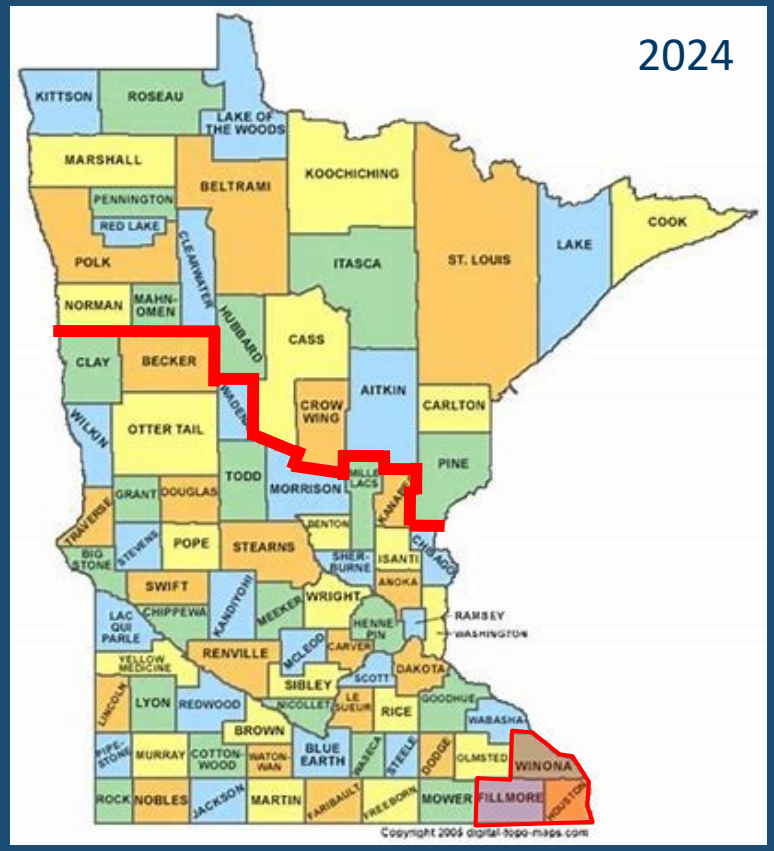
Revising Climate Zone Map

§5.1.4 Climate Zones Changing

Zone 7 to Zone 6A

- Becker
- Clay
- Grant
- Kanabec
- Mille Lacs
- Otter Tail
- Wadena
- Wilkin





Holding Fillmore, Houston and Winona Counties in Climate Zone 6A

6.4.2.1 Tie Climatic Design Conditions to National Standard

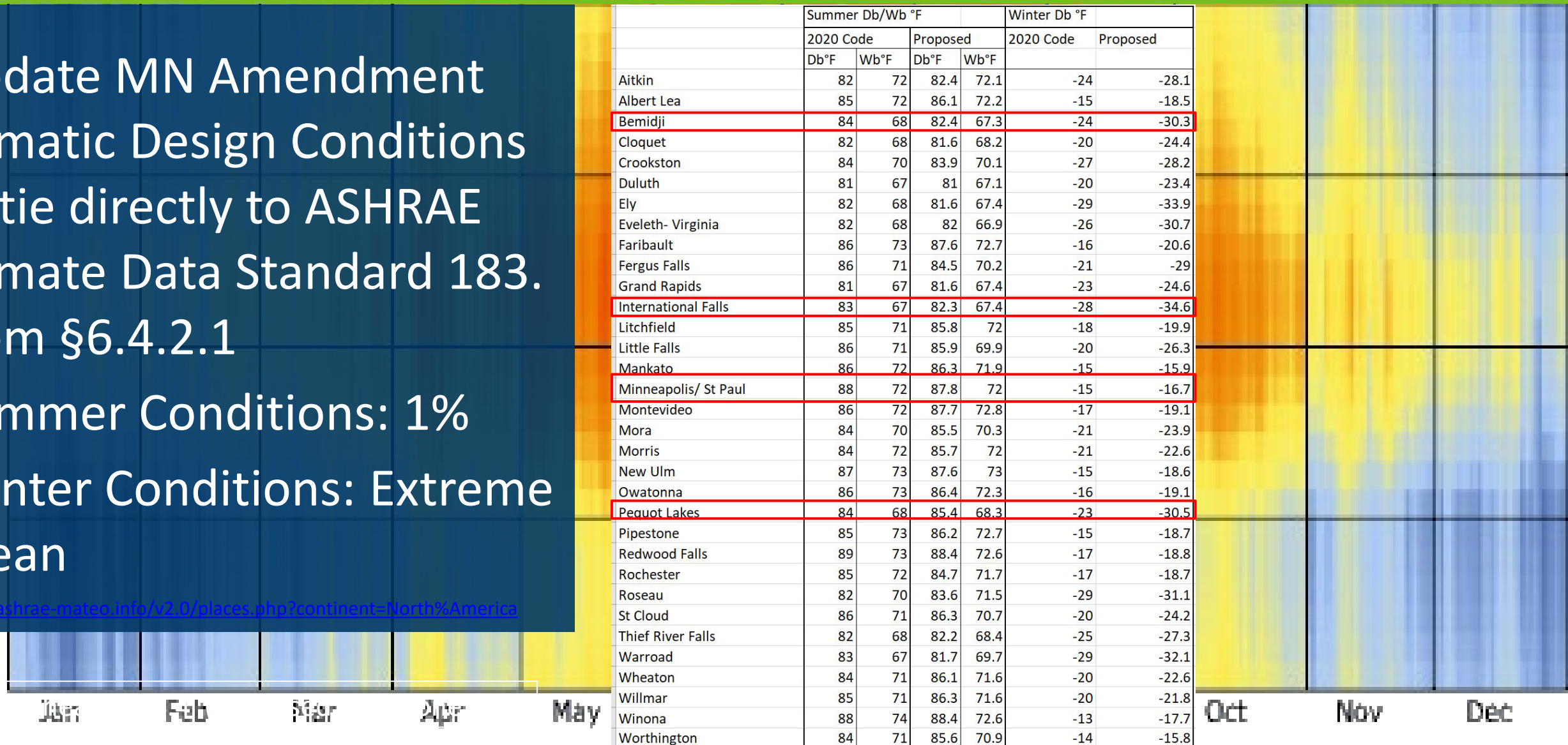
Update MN Amendment Climatic Design Conditions to tie directly to ASHRAE Climate Data Standard 183. from §6.4.2.1

Summer Conditions: 1%

Winter Conditions: Extreme Mean

http://ashrae-mateo.info/v2.0/places.php?continent=North%America

	Summer Db/Wb °F				Winter Db °F	
	2020 Code		Proposed		2020 Code	Proposed
	Db°F	Wb°F	Db°F	Wb°F		
Aitkin	82	72	82.4	72.1	-24	-28.1
Albert Lea	85	72	86.1	72.2	-15	-18.5
Bemidji	84	68	82.4	67.3	-24	-30.3
Cloquet	82	68	81.6	68.2	-20	-24.4
Crookston	84	70	83.9	70.1	-27	-28.2
Duluth	81	67	81	67.1	-20	-23.4
Ely	82	68	81.6	67.4	-29	-33.9
Eveleth- Virginia	82	68	82	66.9	-26	-30.7
Faribault	86	73	87.6	72.7	-16	-20.6
Fergus Falls	86	71	84.5	70.2	-21	-29
Grand Rapids	81	67	81.6	67.4	-23	-24.6
International Falls	83	67	82.3	67.4	-28	-34.6
Litchfield	85	71	85.8	72	-18	-19.9
Little Falls	86	71	85.9	69.9	-20	-26.3
Mankato	86	72	86.3	71.9	-15	-15.9
Minneapolis/ St Paul	88	72	87.8	72	-15	-16.7
Montevideo	86	72	87.7	72.8	-17	-19.1
Mora	84	70	85.5	70.3	-21	-23.9
Morris	84	72	85.7	72	-21	-22.6
New Ulm	87	73	87.6	73	-15	-18.6
Owatonna	86	73	86.4	72.3	-16	-19.1
Pequot Lakes	84	68	85.4	68.3	-23	-30.5
Pipestone	85	73	86.2	72.7	-15	-18.7
Redwood Falls	89	73	88.4	72.6	-17	-18.8
Rochester	85	72	84.7	71.7	-17	-18.7
Roseau	82	70	83.6	71.5	-29	-31.1
St Cloud	86	71	86.3	70.7	-20	-24.2
Thief River Falls	82	68	82.2	68.4	-25	-27.3
Warroad	83	67	81.7	69.7	-29	-32.1
Wheaton	84	71	86.1	71.6	-20	-22.6
Willmar	85	71	86.3	71.6	-20	-21.8
Winona	88	74	88.4	72.6	-13	-17.7
Worthington	84	71	85.6	70.9	-14	-15.8



Building Envelope Trade-Off Compliance Path

§5.5.4.5 [COMcheck] Option

- The Building Envelope Trade-Off Option is what COMcheck uses to verify energy code compliance for buildings that don't follow the prescriptive requirements exactly.
- Pacific Northwest National Laboratories will be releasing a Minnesota version COMcheck MN in December 2023.

COMcheck MINNESOTA